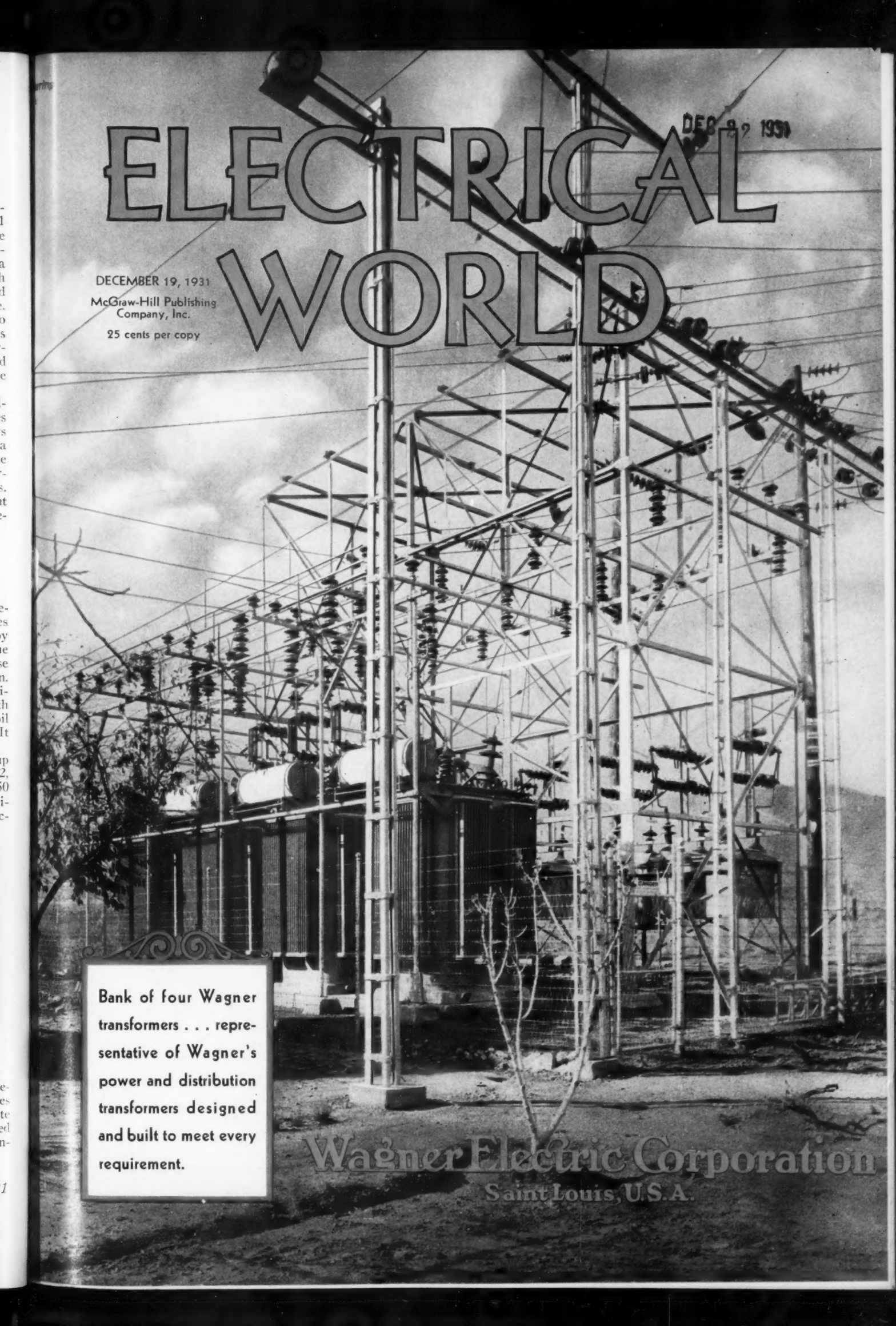
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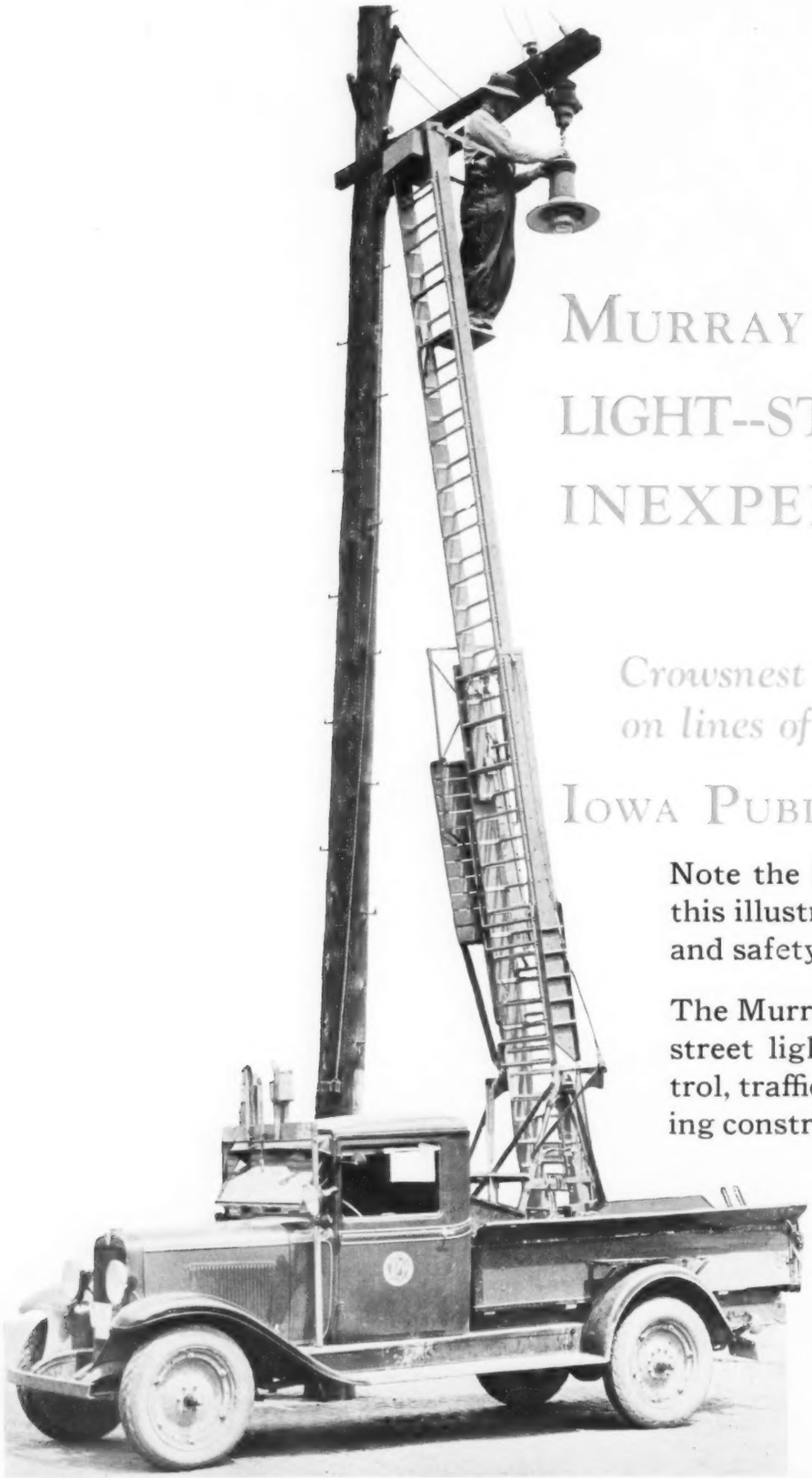
Saint Louis, U.S.A.



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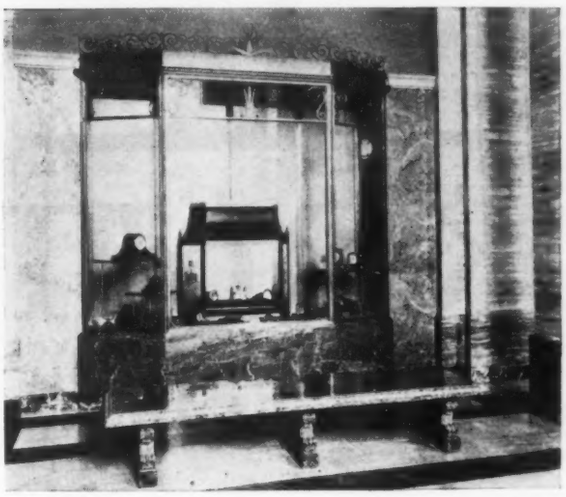

Appliance sales, Southern California Edison Company, Los Angeles

DECEMBER 19, 1931

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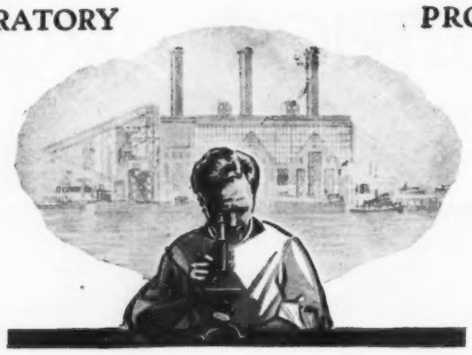

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ELECTRICAL WORLD

Established 1883. McGraw-Hill Publishing Company, Inc.

for the Week Ending

December 19, 1931

Competition for New York utilities?

—**Franchise for rival interest** is latest step in New York City affairs. Aftermath of rate revision and submetering opposition wins approval of Mayor Walker, who thinks Edison rates too high. Commission has yet to act—*p. 1070.*

—**Muscle Shoals bill in House.** Alabama and Tennessee would pay $100,000,000 in 25 annual installments under measure introduced by Representative Rich of Pennsylvania. Some power could be sold but fertilizer comes first—*p. 1071.*

We do not know whether, in the long run, it (ultra-violet irradiation) is good for you or bad for you. We do know that in certain cases it is bad for people, and there are indications that in other cases it is good.

JAMES E. IVES,
Physicist
U. S. Public Health Service.

Commission opposes isolated plants

—**Indiana board denies petition** which would have given a hearing to municipality seeking to acquire utility property by condemnation. "Indiana would step back 20 years" is response—*p. 1073.*

—**Electric ranges improving** under co-operative program for better regulation. Servicing simplified by grouping of units and development of automatic load balancing—*p. 1090.*

—**Inducement rate recoveries** may be expected within sixteen months of the reduction in energy charges when properly planned. About 24 months should see earnings trend established—*p. 1084.*

Impressions of European lighting

—**Task of overseas engineers** due to retarding traditions and conditions is far more difficult than that of American illuminating engineers. Dr. Luckiesh reports on observations abroad—*p. 1094.*

Analysis of apparatus costs shows that circumstances alter cases here too. The lowest bid with lowest energy losses is not always the least costly in the long run—*p. 1092.*

—**Comparison of accident risks** facilitated by hazard index which makes possible the forecast of expectancy of accidents in any given position and permits better protective measures—*p. 1099.*

Mining is 80 per cent electrified

p. 1080.

New York City Franchise Granted to Would-Be Edison Competitor

A 25-YEAR franchise was voted unanimously on December 12 by the Board of Estimate of New York City to the Spingler Electric Corporation to build and operate a plant and transmission system to serve an area adjacent to Union Square where the promoters of the corporation own a large estate from which 70 per cent of the customers will be derived. The proposed construction would involve carrying power conduits under the streets to supply power generated by the corporation. The cost is put at $300,000, and the compensation to the city will be 2 per cent of the gross receipts for the first five years, 3 per cent for the second and third years and 5 per cent for the fourth and fifth years, with a minimum sum of not less than $5,000. For the remainder of the franchise period, to which an extension clause covering another 25 years applies, the terms are identical with those prescribed for similar street-use grants.

The New York Edison Company opposed the grant, pointing out that the franchise would be used as a precedent, with the likelihood of other similar franchises being granted and that the loss of profitable territory might force the company to raise rates, but Mayor Walker declared that the Edison rates are too high and, on the assurance from counsel for the Spingler corporation that his clients had "ability and desire" to make cheaper ones, he moved that the franchise be granted. What view the Public Service Commission will take when the corporation asks it for a certificate of convenience and necessity remains to be seen. The application is regarded as largely an outcome of the submetering situation in New York.

The Edison companies have asked the New York Public Service Commission to dismiss Mayor Walker's recent formal complaint against their rate schedules, holding that, since the rates complained of are not those paid by the city, his complaint has no legal standing and that, moreover, the complaint has no merit.

▼

Mohawk Valley Controls Associated System Plants

BY A REGROUPING of the light and power properties of the Associated Gas & Electric Company in western, central and eastern New York State they all, with the exception of the Staten Island Edison Corporation, have come under the ownership of the Mohawk Valley Company, which thus becomes the principal Associated holding company.

Besides the Rochester Gas & Electric Association, which the Mohawk Valley Company has controlled since 1905, the companies affected by the new arrangement include the New York State Electric & Gas Corporation, which serves Plattsburg, Binghamton, Ithaca, Cortland, Lockport, Endicott, Oneonta and other centers; the Patchogue (L. I.) Electric Light Company, the Elmira Water, Light & Railroad Company and the New York Central Electric Corporation, the latter of which owns the common stock of the Empire Gas & Electric Company.

The New York Central Electric and the Empire Gas & Electric serve Hornell, Corning, Penn Yan, Auburn, Cayuga, Seneca Falls, Geneva and numerous other communities in western and central New York. Finally, Mohawk Valley now controls the Lake Ontario Power Corporation, which serves small communities in northwestern New York, along Lake Ontario.

The bringing together of these properties into a single system has resulted from a plan to co-ordinate and simplify the capital structure of the Associated Gas & Electric System. Most of the properties are or will be interconnected and plans for their complete linking up are under way.

Groups Outside New York State

In addition to this simplification of its structure in New York State, the Associated Gas & Electric also has put into effect a plan for realignment of its properties elsewhere, thus grouping virtually all its operations under three holding companies and one affiliated association.

The electric light and power properties operating in northern, eastern and southern Pennsylvania and in northern New Jersey are now all controlled by the Metropolitan Edison Corporation. These are the Metropolitan Edison Company, the New Jersey Power & Light Company and the Northern Pennsylvania Power Company.

The Associated Electric Company has been used to group most other properties excepting those in New England. The principal units in this group are the Pennsylvania Electric Company and subsidiaries, serving Erie, Johnstown, Clearfield, Warren and other localities throughout western Pennsylvania, and the Kentucky-Tennessee-Indiana Power Corporation.

The affiliated New England Gas & Electric Association has control of properties in Massachusetts, New Hampshire and Maine and in the Maritime Provinces of Canada. The Associated system also controls the Manila (P. I.) Electric Company and scattered utility properties of various kinds in many states not included in the groupings described above.

▼

Institute Committee Selects 1932 Ticket

H. P. CHARLESWORTH, vice-president Bell Telephone Laboratories, New York, heads the official ticket named this week by the American Institute of Electrical Engineers for the offices falling vacant August 1, 1932. His nomination for president by this committee is virtually certain of ratification when the members ballot by mail next spring. A

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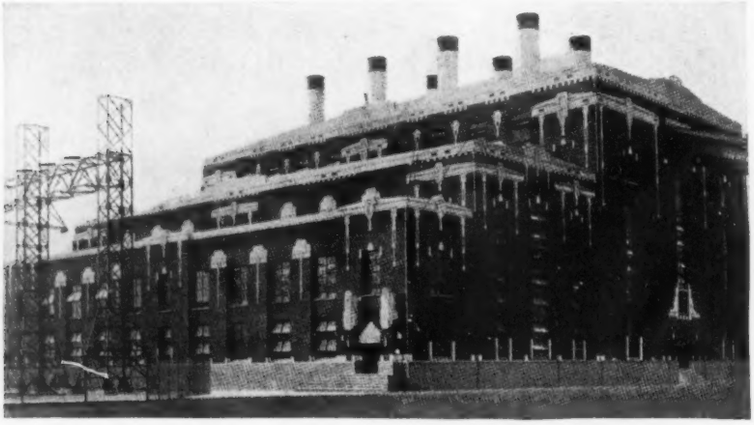
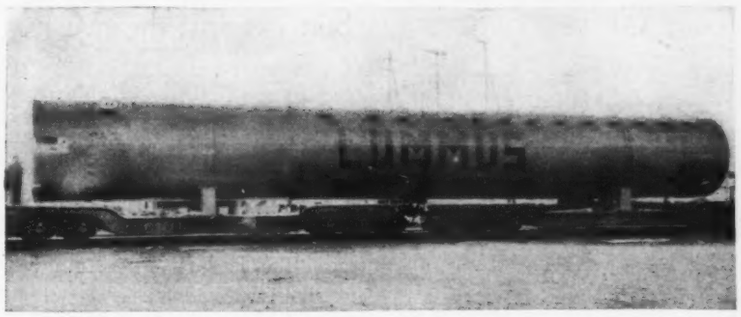
NEW 73,500-KW. HARDING STREET PLANT, INDIANAPOLIS



More than 15,000 visitors inspected this station on the first three days of operation. (See ELECTRICAL WORLD, *November 28, page 938.)*

ARC-WELDING PROCESS PURSUES ITS STEADILY WIDENING WAY



The "bubble tower," or fractionating column, shown on the left was fabricated by the Babcock & Wilcox Company for its affiliate the Lummus Company with General Electric arc-welding equipment The tower is designed to withstand a maximum operating pressure of 150 lb. per square inch and a temperature of 700 deg. On the right is an arc-welded oil-electric G.E. locomotive made for the Bush Terminal Company.

▼ ▼ ▼

biographical sketch and portrait of Mr. Charlesworth will be found on page 1103. The other selections follow:

For Vice-Presidents:

Northeastern District: J. Allen Johnson, chief electrical engineer Buffalo, Niagara & Eastern Power Corporation.

New York City District: E. B. Meyer, vice-president United Engineers & Constructors, Inc., Newark, N. J.

Great Lakes District: K. A. Auty, sales engineer Commonwealth Edison Company, Chicago.

Southwest District: G. A. Mills, chief engineer Central & Southwest Utilities Company, vice-president Pecos Valley Power & Light Company, Dallas.

Northwest District: C. R. Higson, superintendent of distribution Utah Power & Light Company, Salt Lake City.

For Directors:

G. A. Kositzky, chief engineer Ohio Bell Telephone Company, Cleveland.

A. H. Lovell, assistant dean and professor of electrical engineering University of Michigan, Ann Arbor.

A. C. Stevens, in charge educational sales General Electric Company, Schenectady.

For National Treasurer:

W. I. Slichter, professor of electrical engineering Columbia University, New York.

▼

Sleet Storm in South Does Power Lines Little Harm

AN UNUSUALLY HEAVY and extensive ice and sleet storm swept over the Southeastern States from middle Alabama to Virginia last week. Ice formation on wires was very heavy, but absence of wind confined the load on structures entirely to dead weight. Progress in the design of transmission and distribution lines also helped to reduce damage to a minimum.

The center of the storm's intensity was in western South Carolina, there being the heaviest sleet and glare ice in Anderson and Greenville ever known there, with considerable interruption of all wire service. Some high-tension lines went down, but the chief trouble was with local distribution systems. By constant work for more than 24 hours, with line gangs mobilized from other parts of the Duke system, inconvenience to consumers was reduced to a minimum.

▼

Seattle City Light Is Hit by the Hard Times

HARASSED BY CREDITORS and unable to sell bonds, Seattle's City Light Department, over which many a political battle has been waged, finds itself with its back to the wall. The utility is on a warrant basis and has been unable to meet the November installments on machinery and transmission line purchased many months ago. Recent calls for offers for bond issues have brought no response. City officials are considering loaning City Light funds from other departments. Another plan, noticed last week (page 1063), was to sell bonds over the counter to citizens, appealing to their loyalty to the principle of municipal ownership as opposed to the privately owned competitor; but this plan is now said to be illegal in view of an ordinance making it compulsory to advertise for bids. In the dilemma City Light officials announce a 25 per cent voluntary decrease in wages. The office forces are working full time on three-quarters former pay. Outside employees, unionized, are taking one week off in four, still drawing the union scale.

Two immense generators and material for a 120-mile transmission line to bring power from the Skagit River hydro-electric site have been delivered, but the utility has no money with which to construct the power house or to install the power line. Officials of City Light state that the utility in 1930 paid off $1,248,000 in bonded indebtedness and on January 2 will pay $1,000,000 additional. It has earned, the statement says, $18,881,519 during its 25 years over all operating expenses and interest charged, this having been reinvested in extensions and retirement of bonds. Last year's revenue was $4,530,914 and surplus after deducting operating expense and interest $1,837,810. City Light has always been a source of political turmoil in every municipal campaign and was the cause of a recall election six months ago when the then Mayor was ousted.

▼

Bill to Sell Shoals to Alabama and Tennessee

A BILL AUTHORIZING the disposal of Muscle Shoals to the States of Alabama and Tennessee for $100,000,000, to be repaid in 25 annual installments, the properties to be operated under the direction of three groups of three members each, named respectively by President Hoover and the Governors of Alabama and Tennessee, has been introduced at Washington by Representative Rich of Pennsylvania. It is said to be along the lines of a proposal worked out in the summer by President Hoover's War Department representatives on the Muscle Shoals Commission.

The bill provides also for a loan to complete the Cove Creek Dam project. The construction loan would bear 3 per cent interest. The entire indebtedness would be paid off from the earnings of the properties. Fertilizer concentrate would be the principal object of operation, but electricity would be sold at the switchboard to allow as many purchasers as possible to run lines to the plant and transmit the power to any desired point.

Federal Trade Inquiry Brings Out Many Details

"WRITE-UPS" WERE again involved in the testimony affecting the Middle West Utilities Company given on December 9 in the course of the Federal Trade Commission's inquiry into Insull utility organizations. Frank Buckingham, commission examiner, testified that as a result of the acquisition of the Northwest Utilities Company Middle West received $2,000,000 of par-value common stock, consisting of 20,000 shares of $100 par-value stock of Northwest, which it set up on its books at no value. Later, however, at a meeting of the Middle West board of directors, this stock was set up on the books at $25 per share, the examiner said. This same stock, the examiner testified, was shown by records of the company to have been, together with additional acquisitions of Northwest common, "again written up" at a later date. Other similar transactions were cited.

Another subsidiary of Middle West, the Mississippi Valley Utilities Investment Company, was also the subject of testimony.

The acquisition of the United Public Service Company by the Middle West Utilities was described by M. C. Steele on December 10. He said, among other things, that the United company recorded on its books a profit of $739,190 made by selling to the Southern United Gas Company for $750,000 certain assets which had cost the United company only $10,810.

On Tuesday of this week, December 15, the commission took up for examination another holding organization, the North American Light & Power Company, which is owned by Insull, North American Company and Studebaker interests and operates eleven companies in Illinois, Iowa, Kansas and Missouri. Trade Commission examiners gave statistical and factual information along the usual lines of preliminary testimony.

On Wednesday Kenneth A. Miller, commissioner accountant-examiner, went into detail concerning the parent company's corporate activities. Capital assets, he said, grew from $145,040 on December 31, 1915, to $74,884,856 on December 31, 1929. The early stock of the company, 200,000 shares, had a stated value of $5 a share over a series of years. That capitalization never was changed by the company. Its subsidiaries acquired more than $100,000,000 in property appraised by engineers, but never changed the value of its common stock. Assets had no relation at all to stated values of the common stock. At the time of reorganization in 1926 the company was offered $112.50 a share for the common stock, or a total of $22,500,000.

Oliver E. McCormick, vice-president and treasurer of the Middle West Utilities Company, and Mrs. Oliver E. McCormick, former assistant treasurer, were to testify on Thursday concerning the special fund of $44,100 on which Martin J. Insull was examined last week (ELECTRICAL WORLD, December 12, page 1027).

Date for reargument of the commission's case against the Electric Bond & Share Company in the District Court for the Southern District of New York has been tentatively set for January 21. A stipulation of facts having been filed with the court November 4, the next steps are briefing and argument.

▼

EXIT THE COAL RANGE

Premier MacDonald of Great Britain and his daughter, like thousands of their countrymen and countrywomen, become electrically minded.

▼

Holding-Company Control of Interstate Utilities

ADVOCACY BY THE House committee on interstate and foreign commerce of a plan to extend the authority of the Interstate Commerce Commission to cover railroad holding companies is coupled in the committee's report, as it was in the former Congress, with a recommendation that the same authority be vested in the commission as regards holding companies in public utility fields embracing other forms of transportation, the transmission of power and the transmission of intelligence. Representative Rayburn of Texas is chairman of the House committee named.

Nine-Million Radio-Tube Suit Against the R.C.A.

DAMAGES ESTIMATED at $9,000,000 are named in a suit brought this week in the United States District Court at Boston by Raytheon, Inc., formerly the Raytheon Manufacturing Company, Cambridge, against the Radio Corporation of America on the ground of alleged violation of the Sherman act through the leasing of certain patents to competing companies. The plaintiff asserts that his net profits have greatly decreased as a result. The Raytheon company also filed a bill in equity in the Supreme Judicial Court of Massachusetts to enjoin the Radio corporation from terminating a license granted to the plaintiff under which it claims authority to sell radio tubes on a basis of 10 per cent royalty and a minimum payment of $50,000 per year.

▼

Zimmermann and Klein Address Philadelphia Men

FORMAL OPENING of the new headquarters and permanent lighting exhibit of the Electric Association of Philadelphia packed the dining and seating capacity of the Bellevue-Stratford Hotel ballroom, Philadelphia, at a dinner on December 16. In referring to the joint business developments made possible by this association, which could never have been accomplished by any single unit of industry alone, President H. P. Liversidge declared that dealers, contractors, manufacturers and the Philadelphia Electric Company had been able to develop $1,000,000 worth of business this past year by joint merchandising of ranges alone.

After discussing the question "Is the electrical industry doing its job?" John E. Zimmermann, president of the United Gas Improvement Company, expressed himself as opposed to federal regulation but advocated that holding companies make complete periodic statements of financial conditions, management fees and contracts with subsidiaries. If objectionable practices exist in the utility field, he said, the offending companies should be disciplined instead of discrediting the entire industry.

Dr. Julius Klein called attention to information contained in the new government distribution census on how consumers are spending their money and where, it being pointed out that nearly one-third of the electrical retail business in Pennsylvania is being done by non-electrical dealers. Trade associations are more necessary than ever, Dr. Klein declared, because of the complexity and vastness of business.

New Utility Proposals in Wisconsin Legislature

TO ELIMINATE the legal difficulties that the courts have interposed to the 1931 law to make utilities pay the cost of investigation by the state, Senator O. S. Loomis has introduced in special session of the Wisconsin Legislature a bill changing the law (1) by providing for notice and an opportunity for the utilities to be heard; (2) by providing a top limitation of special assessment costs of 5 per cent of the gross operating revenue, a figure which he admits is far too high, but which, he says, will never be assessed; (3) by reducing the penalty for delinquent payments from 15 to 6 per cent; (4) by providing that a utility may raise legal and constitutional issues as a defense if an action is brought to collect the assessments, and (5) by "carefully" providing that if any clause in the act is declared unconstitutional the rest of it will not be affected.

The Wisconsin Public Service Commission in the last few months has added two new departments and increased its work threefold. The ultimate cost of this added activity will be more than $500,000 annually, as compared with the annual appropriation of $180,000 last given its predecessor, the old Railroad Commission. The statute it is now proposed to amend provides that the expense involved in the enlarged field of regulation shall be borne chiefly by the utility companies regulated.

A fight is in prospect over a bill introduced by Senator Walter Rush for the repeal of a law authorizing the acquiring of more land and the enlargment of the reservation system on the upper Wisconsin River, which stores water for the stabilization of Wisconsin water powers. The bill was supported at the regular session by Senator Rush. The water-power men will fight its repeal, claiming that they have already made large expenditures for the improvement of the reservoir system. Claim is now made that the reservoirs are an interference with the normal flow of the river.

The Wisconsin River water power extend from Tomahawk to the Sauk City dam and also include the large hydraulic plant at the Wisconsin Dells. Both the Milwaukee Electric Railway & Light Company and the Wisconsin Power & Light Company obtain part of their power from Wisconsin River plants.

▼

St. Paul Franchise Vote; Municipal Plant Agitated

ST. PAUL, MINN., will vote on January 12 (instead of later) on a new 20-year power franchise for the Northern States Power Company, the present one expiring on January 1. The cost of the special election, estimated at $16,000, will be borne by the company. (ELECTRICAL WORLD, November 7, page 811.)

Proposals for the establishment of a municipally owned light and power plant for the city are being obtained by the Independent Voters' League. Its advocates maintain that such a plant would serve St. Paul just as efficiently as the Northern States Power and would save the city $2,000,000 a year, including $724,500 accruing to citizens from a 15 per cent cut in rates. Cost of construction is placed at $19,550,000, to be met by a bond issue retirable in 20 years.

▼

Isolated Plants Condemned by Indiana Commission

CLAMOR FOR RATE REDUCTIONS and agitation for public ownership, which have reached large proportions in Indiana, were probably instrumental in eliciting from members of the Public Service Commission of that state an opinion explaining a recent three-to-two vote of the commission refusing a hearing to North Manchester on its petition for permission to acquire by condemnation the property of the Northern Indiana Power Company in that city and operate it as a municipal plant.

As interpreted in the opinion, the condemnation law gives municipal governments the right to condemn for public ownership a utility which has within the corporate limits of the city the major portion of its property used and useful for serving that municipality. The commission asserts knowledge that the

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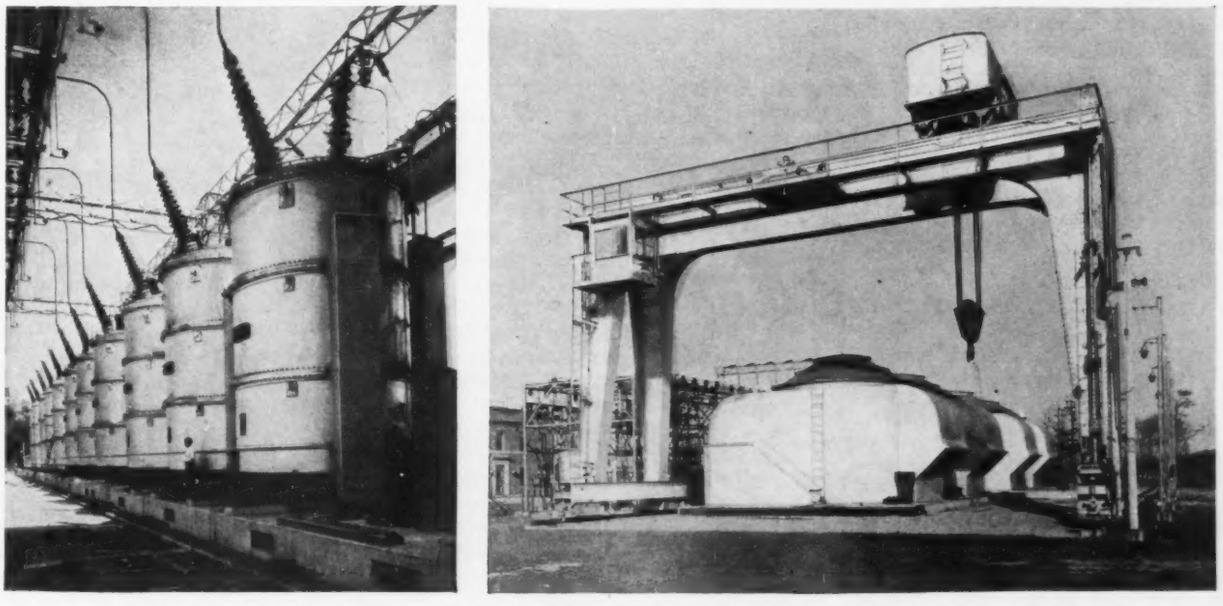
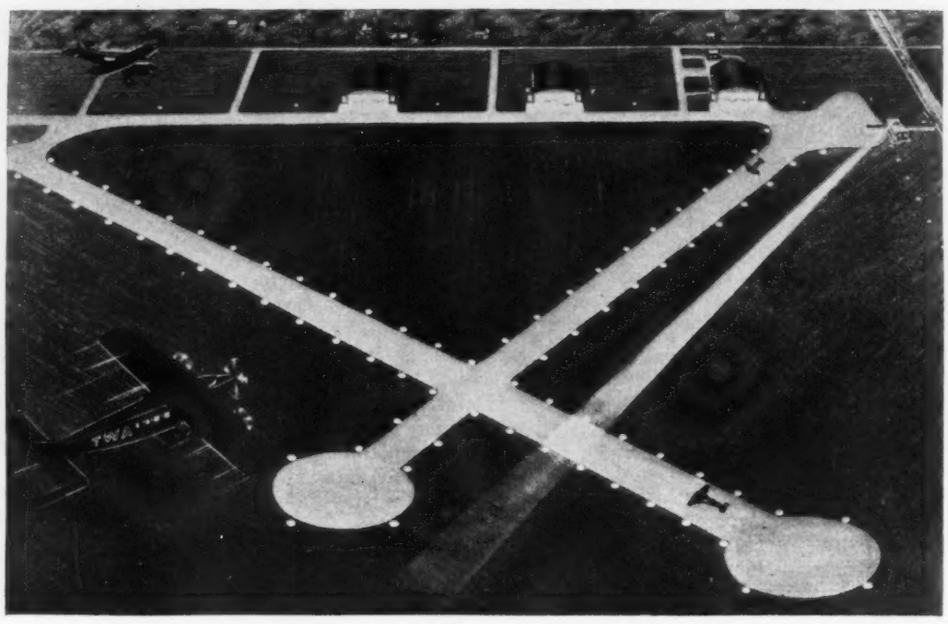
ONTARIO HYDRO SYSTEM EQUIPMENT AT LEASIDE MAKES REMARKABLE RECORD



Four 45,000-kva. transformer banks out of six (two recently installed) at the Toronto-Leaside station of Ontario Hydro are shown on the left and four 25,000-kva. outdoor condensers installed at the same station on the right. The latter are vertical-shaft units and have a perfect operating record according to E. T. J. Brandon, electrical engineer of the provincial commission.

PORT COLUMBUS AIRPORT INSTALLS NOVEL RUNWAY LIGHTING SYSTEM

Port Columbus, Ohio, has placed in operation a system of runway lights which marks an advance of significance. A row of Westinghouse marker lights is installed along each side of the two long runways with the top of each lens flush with the surface of the field. The light is directed upward and shows the incoming pilot two clearly defined pathways on which he may alight at night and on dark days in winter with perfect safety. The 77 runway lamps are turned on after a 12,000-000-cp. floodlamp is turned off.



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major part of the utility property serving North Manchester is not in that place, the distribution system there being only "a small part of a distribution system served from centralized power plants."

Summing up, the opinion said:

If a law is to be administered by any branch of our government, that branch charged with the administration of that law must consistently travel in one direction and cannot with justice to the public build up today and tear the same thing down tomorrow. In other words, it is impossible for any administrative branch of our government to attempt to travel in two directions under the authority of the same law. If the petition of North Manchester in this case were sustained, a precedent would be set up whereby every city and town in Indiana could purchase the used and useful property within that municipality and adjacent territory, install their own individual generating plants and leave all of the transmission systems which have been built up throughout these years and all the large generating plants as property of no value and of no use to the public; the securities issued to pay for the construction of such a system would be of absolutely no value whatsoever, and all of the recognized value of centralization of generation of electrical power and the conveyance of the same by transmission systems would be done away with; the development of territory, both agriculturally and industrially, would cease, and Indiana would step back twenty years and all of the progress made during these years and recognized as one of the very vitals of the future welfare of this state would go for naught.

Appeal from the commission's ruling is to be made to the Indiana Supreme Court by North Manchester.

Muncie, Marion, Valparaiso, Brazil, Kokomo, Winchester and Connersville are a few of the Indiana cities where agitation in one form or another for lower rates is going on vigorously.

▼

Duke Power Company Takes Half-Mill Tax to Court

ALTHOUGH PREVIOUSLY the Duke Power Company had refrained from joining other South Carolina electric utilities in such litigation, it has now filed suit in the United States District Court at Charleston to recover $33,620, with interest at 4 per cent, for payments made under protest to the South Carolina Tax Commission for October and November under the act of the 1931 General Assembly levying a tax of half a mill per kilowatt-hour on electric power generated or sold in South Carolina. The power company attacks the constitutionality of the act on the grounds that it imposes a burden on interstate commerce and that it is discriminatory and confiscatory.

The complaint says that the Duke Power Company generated 40,235,000 kw.-hr. in South Carolina in October and 27,005,100 kw.-hr. in November, which was used in part in interstate commerce and was in part sold and distributed to others over and by means of its interstate electric power system. It asserts further that without demands from customers in North Carolina the generating plants in South Carolina could not operate.

Scattered Happenings in the Electrical Sphere

UNITED STATES

Thirtieth Anniversary of Wireless

Last Saturday, December 12, the thirtieth anniversary of the first transmission of a signal by radio across the Atlantic was celebrated by a world-wide broadcast in which fifteen nations were represented. Signor Marconi, speaking from London, described his triumph of 1901, and experts spoke from various European and South American countries, Japan, Australia and elsewhere. David Sarnoff, president Radio Corporation of America; Dr. M. I. Pupin and Major-General Charles McK. Saltzman spoke from the United States.

Pullman, Wash., Against City Plant

By 649 to 279 the voters of Pullman, Wash., on December 8 defeated the proposal that the city should take over the distribution system of the Washington Water Power Company and run it as a municipal plant. A majority of the City Council had favored this action, and three months of public discussion preceded the vote.

Lincoln, Neb., Has New Power Plant

Three hundred leading citizens of Lincoln, Neb., met recently at a banquet, as guests of the Iowa-Nebraska Light & Power Company, to celebrate the completion, after two years' work, of the new plant of the Iowa-Nebraska Light & Power Company, which, with headquarters at Lincoln, serves 246 places with energy. The plant contains two

10,000-hp. boilers of very modern type, one fed by coal and one by natural gas. B. J. Denman, vice-president and general manager of the United Light & Power Company, the parent corporation, and L. R. King, its president, spoke at the banquet.

Little Rock's City Plant to Stay

Necessity of a special election to determine whether the city of Little Rock, Ark., shall dispose of the municipal power plant (ELECTRICAL WORLD, December 12, page 1031) has been removed by the action of the bidder, who has now withdrawn his offer to purchase the equipment.

Arizona Rates, Too, Come Down

Ending a controversy of years' standing, the Arizona Corporation Commission has ordered reductions in the electric and gas rates of the Public Utilities Consolidated Corporation, Nogales division. The reductions range from 15 to 25 per cent and the order is retroactive to October 20. The minimum for residential electric lighting is $1.20, with 12 cents as the rate for the first 30 kw.-hr., 10 cents from 30 to 100, 8 cents from 100 to 400, 5 cents from 400 to 1,000 and 4 cents for all over that amount.

Ohio Commission May Punish Contempt

Power of the Ohio Public Utilities Commission to cite for contempt witnesses who refuse to divulge information has been upheld by the Ohio Supreme Court. Three such witnesses, cited for contempt, received jail sentences from the Franklin County Common Pleas Court, and it is their appeal that has just been heard.

Twenty Illinois Utilities Cut Rates

Twenty of the 39 utility companies rendering electric service in Illinois made reductions in electric rates during the year ended June 30, 1931, according to a report issued by the engineering section of the Illinois Commerce Commission. The report says that these 20 utilities serve approximately 90 per cent of all users of electricity in the state. The saving to users amounted to approximately $2,680,000 for the year.

Tennessee Electric Power Budget

Construction in 1932 for the Tennessee Electric Power Company will aggregate approximately $2,000,000, the company estimates. About $450,000 will be expended in the Chattanooga district, a similar sum in the Nashville district and the remainder throughout the state. No new development projects or high-voltage line extensions are planned.

St. Louis Utility May Buy Power Plants

The Missouri Public Service Commission has under advisement a joint application from the St. Louis Public Service Company and the Union Electric Light & Power Company under which the former, an electric railway company, is seeking to sell its two electric power plants to the Union Electric for $2,100,000. The sale is contingent on the railway company being able to negotiate a new contract with the Union Electric to supply all of its power needs. At present it buys 90 per cent of its power from the Union Electric.

Rates Upheld in Unprofitable Territory

Under present economic conditions the Gardner Electric Light Company, a subsidiary of the New England Power Association, may maintain its existing rate schedule in the town of Rutland, Mass., the Massachusetts Department of Public Utilities has decided. The residential schedule starts at 11 cents per kilowatt-hour for the first 25 kw.-hr. used, a room rate starting at 75 cents a month for seven active rooms and 7 cents per kilowatt-hour. The town has an area of 34 square miles and a population of 1,500 excluding sanitarium inmates. Nearly half of the customers use less than 25 kw.-hr. per month, and the dividend return to the company averages 6.4 per cent.

Three-Cent Energy Proposed

Legislation proposing maximum and minimum charges for electric, water and gas companies has made its appearance in the Pennsylvania Legislature at a special session called for specific purposes of which utility regulation is not one. The measure fixes a 3-cent kilowatt-hour price for electricity with a minimum charge of 50 cents a month and prohibits "readiness-to-serve" charges.

Niagara Falls Hearing Postponed

Postponement until January 18 of the hearing before the Federal Power Commission on the application of the Niagara Falls Power Company to make permanent its temporary license to divert an additional 275 sec.-ft. of water, bringing its total diversion to the treaty limit of 20,000 sec.-ft., was announced last week. The company's accounts, declared by the commission's chief accountant, William V. King, to be inflated, are involved in these hearings.

Accounting Revision in Wisconsin

Results of the Wisconsin Public Service Commission's inquiry into utility accounting practice, referred to on November 14 (page 854), are the adoption of the "fixed-capital purchase adjustment" already outlined and the requirement of more detailed information in accounting for transactions with affiliates and in accounting for revenues. The revision, the commission explains, is not complete, it being impracticable to make all the contemplated changes effective on short notice.

Detroit Reduces Street Lighting

An unusual method of saving, at the expense of good street lighting, has been adopted by the city of Detroit, which has cut the voltage supplied to 19,000 street lamps by 10 per cent, reducing the degree of illumination, it is estimated, by about 30 per cent. This is part of the Public Lighting Commission's economy program and is expected, Detroit newspapers say, to save about $76,000 annually in municipal lighting bills.

Coming Meetings

American Engineering Council—Washington, Jan. 14-16. L. W. Wallace, 744 Jackson Place, Washington, D. C.

American Institute of Electrical Engineers—Winter convention, New York, Jan. 25-29; district meeting, Milwaukee, March 14-16. F. R. Hutchinson, 33 West 39th St., New York.

Conference of Electrical Leagues—Philadelphia, Jan. 25-27. Society for Electrical Development, 420 Lexington Ave., New York.

North Central Electric Association—Commercial Section, Lowry Hotel, St. Paul, Jan. 29 and 30; Engineering Section, St. Paul Hotel, St. Paul, Feb. 22 and 23. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

National Electric Light Association—Group committee meetings: Engineering National Section, New York, Feb. 1-5; Accounting National Section, Statler Hotel, St. Louis, Feb. 15-17. A. J. Marshall, 420 Lexington Ave., New York.

Oklahoma Utilities Association—Tulsa, Okla., March 8 and 9. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

CANADA

Developed Hydro in Ontario 2,546,886 Hp.

Electrical energy developed in Ontario represents 37 per cent of potential possibilities under existing treaty rights, according to a report on water powers of the province prepared by L. V. Rorke, surveyor-general in Ontario, in co-operation with the Dominion Department of the Interior. Developed energy totals 2,546,886 hp. This figure includes 830,000 hp. under construction in the Abitibi River Canyon and 112,000 hp. under construction at Chats Falls on the Ottawa River. Total estimated capacity of water powers in the province at 80 per cent efficiency is: At ordinary minimum flow, 3,806,237 hp.; at ordinary six months' flow, 5,339,273 horsepower.

ABROAD

Rural Service in Great Britain

Intensive rural development is expected as a result of the extension of the national grid system to the British countryside, according to E. W. Dickinson, rural development officer of the Electricity Commission, who says that steps will be taken to develop agriculture on intensive lines. Horticulture, with the soil heated by electricity; district milk depots and butter factories, large-scale poultry farming and the development of the canning industry in rural sections are among the enterprises foreseen.

Christmas tree, Twin Peaks, San Francisco—Californians, Inc., Photo

Merry Christmas

EDITORIALS

L.W.W.MORROW
Editor

Who gets the net?

IN GOOD times American business can salvage anywhere from 3.8 to 6.05 per cent of its gross income receipts for net. Moreover, if the average of the past ten-year period can be called normal in spite of its dizzy heights and dull valleys, the whole business structure is conducted on a margin of 4.5 per cent of gross available for net. All the hustle and bustle of boom years fails to raise the percentage more than 1.5 per cent above the average. By such an analysis the prosperity year of the last decade was 1925 and not 1929. Such at least is the inference from the statistics of income for 1930 just released by the Treasury Department's Bureau of Internal Revenue.

These ratios are obtained by lumping the gross incomes of corporations which showed a profit with those which operated at a deficit and then deducting the total deficits from the total of reported net incomes. Sad to relate, 231,287 out of 498,110 of the 1930 returns so far filed showed such a deficit. The amount of this 1930 deficit is $4,200,000,000, nearly twice that of the normal preceding years, but exceeding only slightly the loss of $3,900,000,000 in 1921, the other depression year. The significant thing is, however, that the aggregate net income of profitable enterprise is only $5,600,000,000, just a little over half the average for the preceding years. American business of 1930 was conducted on the low level of 1.17 per cent of gross applicable to net. Maybe that explains why common stocks look so unattractive all around.

Unfortunately the utilities are lumped with profitable and unprofitable railroads and street railways, so that all one can say is that $11,600,000,000 of gross for that group in 1930 produced only $800,000,000 of ultimate net income. That does not explain why utility stocks, in a class representing a 6 per cent net, should suffer the same fate on the exchanges as manufacturing stocks, which showed only $900,000,000 of profit on a $5,200,000,000 volume of gross. Some of the answer is found in the radical difference between the two groups as to investment ratio and capital turnover.

There is little consolation in extending these analyses. With 1930 tax receipts from corporations and individuals down to about half their 1929 figures, more tax on the shrunken incomes of 1931 is as sure as death. Another thing that is equally sure is that government never really curtails its expenditures to match its purse. Nothing short of revolution has ever taught politicians to order the affairs of his majesty the State in the way the humble individual has to readjust his outgo to fit his income.

Marconi predicts broadcast energy

THIRTY years ago Guglielmo Marconi confounded scientists by sending three dots through space across the Atlantic and thus proved transatlantic radio communication possible. In London on December 12, 1931, he said: "I think the time will come when our lighting, our motive power and our airplanes will be operated by broadcast power. My own experiments are being conducted with that end in view."

This is the prophecy of a mature engineer and scientist. It is not the same as the daring venture of the twenty-six-year-old Marconi of thirty years ago who said that radio waves were not affected by the curvature of the earth and then proved his statement. It is the deliberate assertion of a man who knows the limitations to the accomplishment of his prophecy better than any other man and yet dares to make it. Always imaginative

but never visionary, the Marconi of today is searching for the practical consummation of his reasoned predictions.

Marconi is the type of man the world needs, and the tribute of fifteen nations paid him last Saturday is evidence of his place in science. Moreover, it indicates the belief of millions that no one dares to place limits upon his further contributions to mankind. America first believed in Marconi thirty years ago and will maintain its faith in the man as he strives to accomplish his inventor's ideal of a world operated by broadcast power.

Standardized customer-service records will aid utilities

EFFORTS are being made by the system-operating committee of the Pennsylvania Electric Association to ascertain whether records of customer service can be standardized by its member companies. Such an undertaking seems to meet a current need and should have national interest. With an acceptable standardized basis for tabulating service records it would be possible for companies to give publicity to service improvements they have made as well as to those which may be accomplished in the future. Many of these improvements are not appreciated and understood as they should be.

Standardized service records will make available facts which can be used to refute ignorant or untruthful statements by antagonistic politicians and others. By the unified plan the average improvement of the industry can be told accurately. The fact that these improvements are being obtained without any increase in rates is a fact deserving publicity.

An engineering benefit will result from such a plan, as the comparisons of records of various companies with the reasons for any differences will bring out the best in operating practices, design and construction methods. Most companies keep records of interruptions to their lines or customers, but the extent of these records and the way these are reported differ greatly.

The public service commissions may be expected in the future to require information concerning the customer-service records from the electric utilities. Such information has already been prepared for the regulatory bodies in certain states. It is to the advantage of the utilities to agree on a standardized manner of presenting this information.

British cite experiments with cable under gas pressure

SURROUNDING a cable with nitrogen under pressure seems to offer an escape from some of the limitations to cable operation. External gas pressure applied to the lead sheath counteracts the tendency that its expansion will create voids and thus call for reserve oil to fill them. The pipe inclosure suffices to eliminate oil pressure tanks and stop-joints, but of course there is the question whether it would lend itself readily to the conventional type of duct and manhole construction.

Messrs. Hochstadter, Vogel and Bowen recently related their studies on this type of cable to the Royal Society of Arts. Improved stability permits it to be loaded up to the economic limits of copper loss without regard to the heating of the insulating material, and this signifies a gain of from 40 to 60 per cent in kilowatt capacity. Such a margin may be possible in the case of European practice, with its lower operating temperatures, but not necessarily in the United States, where temperatures normally approach the limits for cellulose materials. The time-voltage characteristic is, however, such as to permit twice as much voltage for the same insulation thickness. Carrying capacity is thus gained up to three and two-tenths times that for the ordinary varieties of cable.

The development holds promise of virtue in the field of 33 kv. and upward, primarily because it affords chance to remove one impediment to flexible operation of metropolitan distributing cables. If the economic gain from more volts per mil justifies lower normal operating temperatures, then the cable can acquire the same latitude of temporary overloading which the connected generators and transformers have. Adding this feature to the narrowed spread in cost between open wire and cable in duct, one may justify the hope that this development will be explored to disclose any latent weakness as well as to confirm its advantages. Cable is still in the evolutionary stage. Most of the nervousness in system operating hinges on cable that has to be nursed through fluc-

tuating load cycles. Every effort to substitute complacent confidence for this nervousness is something to be encouraged.

Progressive increases in secondary voltages of distribution transformers

IT IS to be hoped that the preferred voltages recently approved jointly by the N.E.M.A. and the N.E.L.A. will result in a marked increase in the standardization of all kinds of electrical apparatus. Especially is this desirable for apparatus produced for stock, such as distribution transformers. It is interesting to recall at this time how secondary voltages have increased as the size and average load of distribution transformers have increased.

The start was with only 50 volts, because the incandescent lamp could then be produced more cheaply and reliably at this voltage than at 100 volts or more. In connection with the early use of this low voltage some readers may recall a few installations (made when a 2-kw. transformer was a large one) in which five or more transformers were distributed, one above the other, on the walls of office buildings, and connected in parallel to the secondary mains, in order to minimize the drop in voltage. These installations might be considered the original vertical networks, soon to be abandoned for thirty years, but now becoming again common in modern skyscrapers, but with three-wire, 240-volt mains.

Soon, however, as transformers increased in size and consequently became cheaper and more efficient, the advantage of the low-voltage lamp became negligible compared with the cost of the necessary secondary copper mains, and consequently the demand changed to 104 volts. In the late nineties the available sizes of transformers had again increased until the operating engineer saw that a great saving was possible by supplying energy to an entire city block, or even a greater area, from one transformer. The result was a considerable demand for three-wire secondaries at various voltages between 208 and 240. There was nothing, however, to concentrate the demand on any particular voltage; in fact, there was a strong tendency to the contrary, as carbon-lamp filaments could not be made for any definite voltage.

Lack of standardization was, therefore, favored by the lamp manufacturer until the advent of the tungsten filament, which because of its method of manufacture readily lent itself to uniform production at any fixed voltage. This helped greatly in transformer standardization, but lack of co-ordination between lamp and motor voltages still made anything like complete standardization impossible.

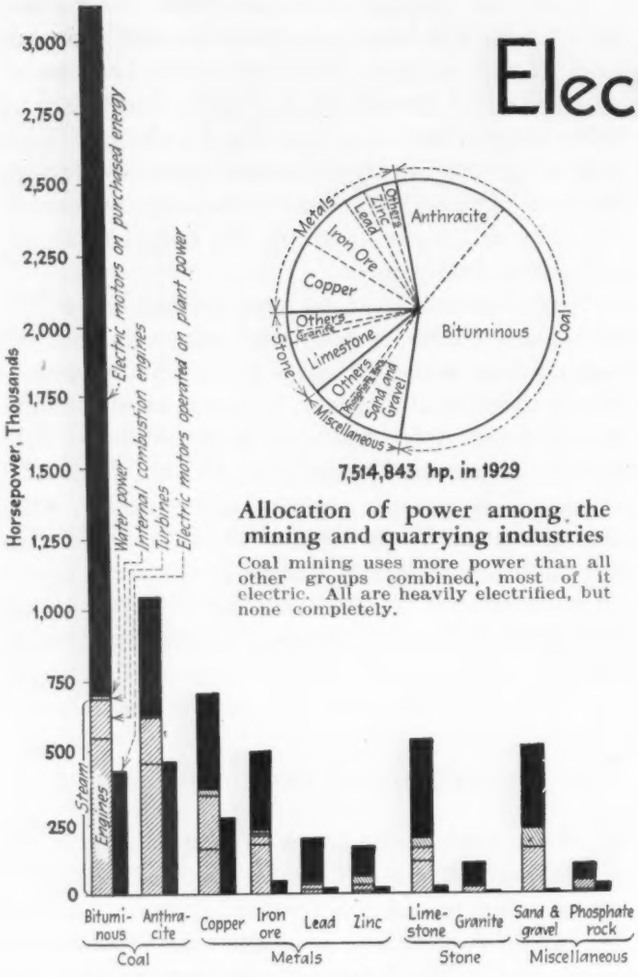
Now, however, with no lamp voltage below 115 and heavy three- or four-wire networks fast becoming the standard way to distribute power where the density is great, it would seem that the motor demand for voltages in the 400-600 field should be confined strictly to isolated industrial service. It would appear, consequently, that something like 90 per cent of the demand for distribution transformers should in the near future be concentrated on those having 240-volt, three-wire secondaries. This would be standardization indeed.

Free engineering service

FREE engineering service from manufacturers to their customers or prospective customers was condemned in a resolution recently adopted by the American Institute of Consulting Engineers. The institute gave two reasons for this condemnation—the first that free engineering service interferes with the work of the independent consulting engineers and the second that it is not fair to the purchasers.

Does not this resolution entirely miss the point? It is not free engineering service as such that should be condemned but the abuse of it. When one purchases equipment from a manufacturer and accepts the manufacturer's offer to design the plant for him free of charge, no one can discover anything unethical in the proceeding. If the purchaser really believes that the manufacturer does not in the end make him pay for the engineering in the cost of the equipment, the worst that can be said about him is that he is foolish, and foolishness is not necessarily unethical, nor can it be cured by resolutions. But when a consulting engineer obtains free engineering information from a manufacturer and presents it to his client or employer as his own and collects a fee or a salary for it, he is acting unethically and is unfair to both manufacturer and purchaser.

Electric Drive Doubles in Mining



Allocation of power among the mining and quarrying industries

Coal mining uses more power than all other groups combined, most of it electric. All are heavily electrified, but none completely.

Horsepower in ten leading groups, 1929

Motor power on energy generated in own plants is charted opposite prime movers to avoid duplication

ELECTRIC power used in mines and quarries more than doubled during the decade from 1919 to 1929, rising from 2,789,383 hp. to 6,124,799 hp. By far the larger part of the increase was in motors operated on purchased energy; 1,558,752 hp. in 1919, 4,771,818 hp. in 1929, the latter being more than three times the earlier installation. Meanwhile the capacity of prime movers decreased by nearly 600,000 hp., or 17.9 per cent, from 3,341,350 hp. to 2,743,025 hp. These changes are disclosed in a report by the Bureau of the Census giving results of the census of mines and quarries for 1929, by industries. A companion report classifies the power by states. Some of the data are abstracted in the accompanying tables.

Adding together the prime movers and motors operated on purchased energy makes the total power requirements of the industry 7,514,843, against 4,900,102 hp. ten years before, in each case exclusive of motors operated on energy generated in the enterprises reporting, to avoid duplication (Table III). Motor horsepower in the last-named group, 1,352,981 hp., while also re-

Table I—Prime Movers, Motors and Generators, by Type and Rated Capacity, in Mines and Quarries

Totals for Industry Groups and for Chief Power-Using Industries in Each Group: 1929 and 1919. (See headnote, Table III)

This table has been condensed. The original, as published by the Bureau of the Census, lists the following number of industries in each group: Coal, 2; Metals, 9; Stone, 7; Miscellaneous, 21.

Industry	Total Rated Capacity, Hp.		Steam Engines, Hp.		Steam Turbines, Hp.		Internal-Combustion Engines, Hp.		Water Wheels and Water Turbines, Hp.		Electric Motors Driven by Purchased Energy, Hp.		Electric Motors Driven by Energy Generated in Enterprise Reporting, Hp.		Electric Generators, Kw.
	1929	1919	1929	1919	1929	1919	1029	1919	1929	1919	1929	1919	1929	1919	1929
All Industries	7,514,843	4,900,102	1,737,858	2,705,554	684,878	473,985	274,208	123,739	46,081	38,072	4,771,818	1,558,752	1,352,981	1,230,631	736,347
Coal:	4,165,652	3,054,848	999,342	1,897,003	305,432	246,444	30,295	22,503	4,660	74	2,825,923	888,824	894,134	893,064	399,467
Anthracite	1,041,465	899,783	455,327	730,141	160,424	50,665	2,291	1,284	.....	.....	423,423	117,693	464,164	185,723	128,395
Bituminous	3,124,187	2,155,065	544,015	1,166,862	145,008	195,779	28,004	21,219	4,660	74	2,402,500	771,131	429,970	707,341	271,072
Metals:	1,685,368	1,319,369	350,652	542,076	264,698	191,914	77,987	71,734	34,663	31,038	957,368	482,607	370,179	271,722	273,381
Copper	701,791	522,426	156,639	245,398	189,123	123,223	19,726	16,327	1,375	1,510	334,928	135,968	270,205	161,024	173,765
Iron ore	498,821	370,859	171,232	231,184	33,017	28,521	4,005	5,397	13,900	8,375	276,667	97,382	40,688	67,595	41,895
Lead	194,380	229,401	7,618	42,821	19,336	35,420	7,813	35,415	3,467	3,871	156,146	111,874	16,422	22,884	20,703
Zinc	163,357	229,401	6,019	42,821	18,252	35,420	30,758	35,415	800	3,871	107,528	111,874	17,206	22,884	19,687
Stone:	829,041	376,748	169,639	194,477	54,547	14,286	57,423	9,045	1,961	2,130	545,471	156,810	23,652	19,210	18,556
Limestone, including dolomite, cement-rock, and calcareous marls	535,466	213,717	110,561	109,778	51,387	10,701	35,233	5,043	1,055	865	337,230	87,330	20,872	11,421	16,832
Granite	108,217	55,614	23,332	30,231	1,245	2,360	6,962	1,343	605	777	76,073	20,903	1,776	1,520	1,412
Miscellaneous:	834,782	149,137	218,225	71,998	60,201	21,341	108,503	20,457	4,797	4,830	443,056	30,511	65,016	46,635	44,943
Phosphate rock	104,146	49,639	7,370	17,140	37,268	17,751	1,880	12,085	.....	.....	57,628	2,663	30,966	33,107	22,722
Sand and gravel	516,745	.....	158,150	.....	740	.....	72,207	.....	.....	.....	285,648	.....	6,591	.....	3,828

Table II—Horsepower in Mines and Quarries in Ten Leading States, 1929

State	Total	Prime Movers	Motors on Purchased Energy	Motors on Energy Generated in Own Plants	Generators (Kw.)
Pennsylvania	2,189,218	873,046	1,316,172	566,986	198,089
West Virginia	670,544	107,923	562,621	91,914	54,032
Illinois	439,462	184,273	255,189	78,497	45,454
Michigan	395,723	243,270	152,453	98,450	66,883
Kentucky	317,973	79,404	238,569	50,206	33,364
Alabama	270,615	54,934	215,681	12,125	16,339
Ohio	228,121	83,510	144,611	16,691	11,095
Minnesota	208,741	110,805	97,936	3,804	4,215
Montana	204,099	18,832	185,267	3,435	1,046
Arizona	202,428	154,894	47,534	167,436	100,153

flecting increased electric drive, had risen only 9.9 per cent.

The degree of electrification by the use of private plants is indicated also by the reported generator capacity, 736,347 kw., which works out as 1 kw. for each 1.83 hp. of motors operated on energy from those generators. Comparable data for earlier years are not available—even in the more frequently taken census of manufactures the item was not included until 1927—but the increase since 1919 can be inferred from the small increase in corresponding motor horsepower.

Table I gives the power installation in each group and in a few leading power-consuming industries of each group. Corresponding data for 1919 have been added from the report for that year. The conspicuous change has been in the horsepower operated on purchased electric energy—more than threefold in coal mining, between two and threefold in iron and copper, nearly fourfold in limestone quarrying. Coal alone absorbed nearly 2,000,000 additional horsepower.

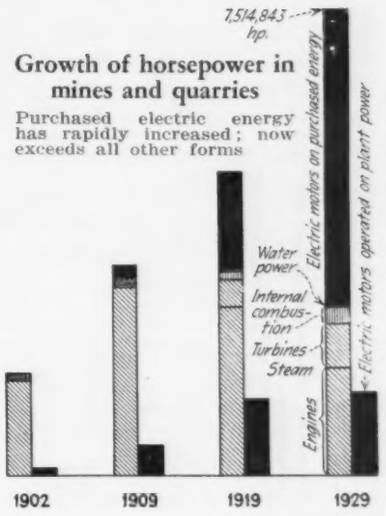
Various important trends and relationships appear, but attention can be called to only a few in addition to those previously mentioned, for example:

1. Purchased electric power supplied nearly two-thirds of the drive in 1929, but less than one-third in 1919. At the beginning of the century it was negligible. (Table III.) By 1909 it had risen to 6.1 per cent of the total horsepower. The next decade brought a sevenfold increase, from 205,489 hp. to 1,558,752 hp., thereby exceeding that on private plants.

2. Of the total power requirements, provided by mechanical prime movers plus motors on purchased power, 81.5 per cent is applied electrically, that is, 6,124,799 hp. The ratio is not strictly accurate, because one motor horsepower in the mine does not necessarily call for just one horsepower of prime movers in the power plant, but it is near enough to show about how far electrification has progressed.

3. Replacement by purchased power affected steam engines predominantly. Turbines, hydraulic power and internal combustion engines increased, but they constitute only 13 per cent of the total.

Internal combustion engines more than doubled in aggregate rating and their average rose from 36.8 to 62.5 hp.



4. Coal mining is largely done by electric power; in the bituminous branch motors on purchased energy make up 77 per cent of the total horsepower, other motors bring electric operation to 91 per cent of the total.

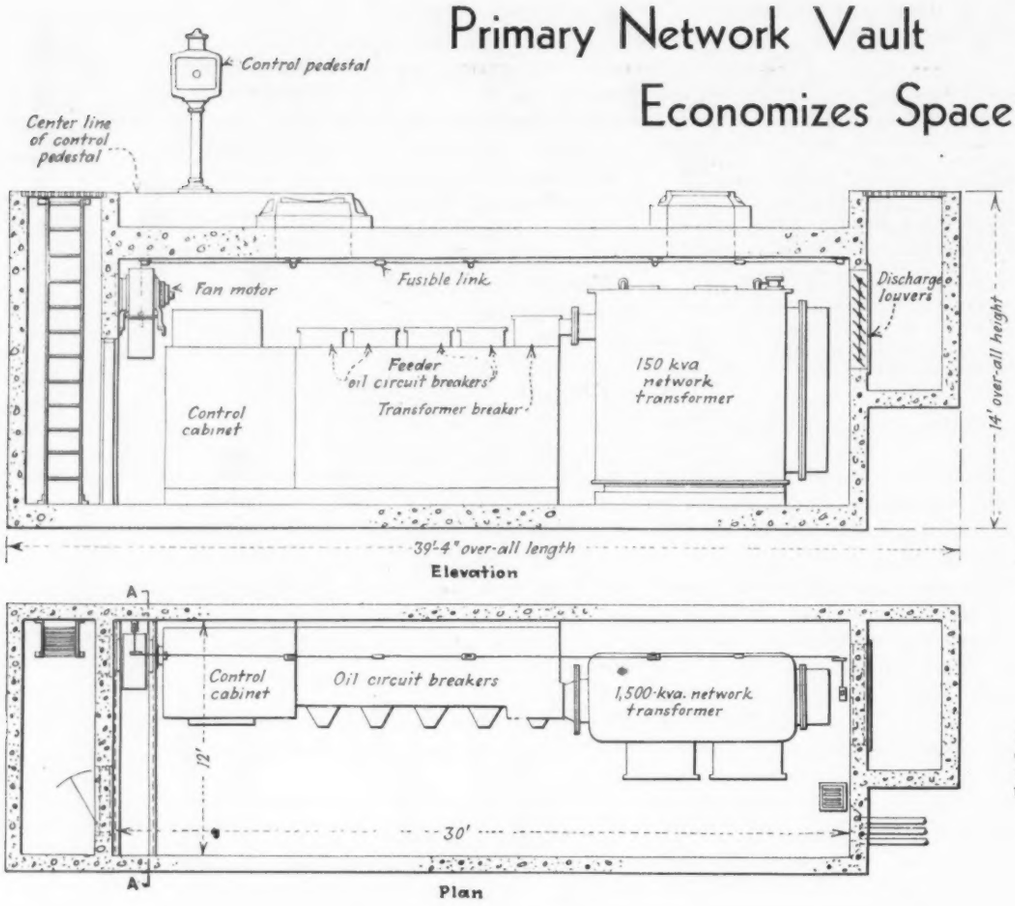
Table III—Prime Movers, Motors and Generators—Combined Statistics for Mining and Quarrying Industries

The statistics for 1929 and for earlier years as shown in this table are not strictly comparable, for the reason that data for the sand and gravel, glass-sand and molding-sand industries are included, for the first time, in the statistics for 1929. (See Table I.) The figures for earlier years have been revised by the omission of data for petroleum and natural gas for 1919 and for petroleum, natural gas and certain minor industries for 1909 and 1902, no data having been collected for these industries in 1929 census.]

	1929	1919	1909	1902	Per Cent of Increase or Decrease (—) 1919-1929	1909-1919	1902-1909
Prime movers and electric motors driven by purchased energy, aggregate horsepower	7,514,843	4,900,102	3,384,759	1,656,254	53.4	44.8	104.4
Prime movers, total horsepower	2,743,025*	3,341,350	3,179,270	1,636,490	—17.9	5.1	94.3
Steam engines:							
Number	*14,144*	*23,021*			*—38.6*		
Horsepower	1,737,858	2,705,554	33,623	21,096	—35.8	—29.9	59.4
Steam turbines:			3,038,435	1,568,230		4.6	93.7
Number	*794*	*553*			*43.6*		
Horsepower	684,878	473,985			44.5		
Internal-combustion engines:							
Number	*4,421*	*3,289*	*1,529*	*585*	*34.4*	*115.1*	*161.4*
Horsepower	274,208	123,739	43,375	9,217	121.6	185.3	370.6
Water wheels and water turbines:							
Number	*125*	*285*	*908*	*959*	*—56.1*	*—68.6*	*—5.3*
Horsepower	46,081	38,072	97,460	59,043	21.0	—60.9	65.1
Electric motors driven by purchased energy:							
Number	*123,811*	*38,659*	*4,763*	†	*220.3*	*711.7*	.....
Horsepower	4,771,818	1,558,752	205,489	19,764	206.1	658.6	939.7
Electric motors, total:							
Number	*157,835*	*70,310* ‡	*18,504*	.....	*124.5*	*280.0*	.....
Horsepower	6,124,799	2,789,383 ‡	690,377	132,763	119.6	304.0	420.0
Driven by energy generated in enterprise reporting:							
Number	*34,024*	*31,651*	*13,741*	*2,411*	*7.5*	*130.3*	*469.9*
Horsepower	1,352,981	1,230,631	484,888	112,999	9.9	153.8	329.1
Electric generators:							
Number	*1,606*	‡	†	†	.....	.....	.....
Kilowatt rating	736,347§	‡	†	†	.....	.....	.....

*Includes 203,825 hp. for inactive prime movers.
†Not reported.
‡No data.
§Includes data for inactive generators with kilowatt rating of 112,884.

Primary Network Vault Economizes Space at Brookline

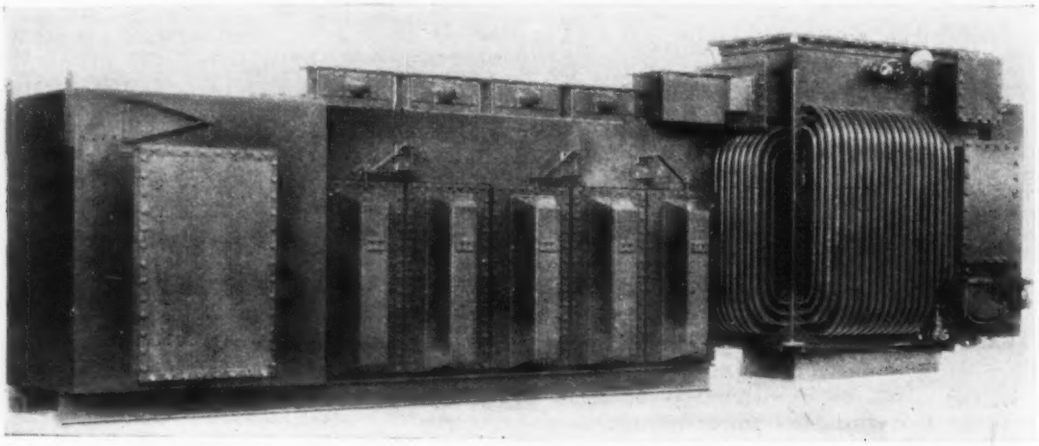


Network vault for Brookline

Provides for direct runs of conductors by the shortest routes features the vault arrangement at Brookline.

At this writing the Edison Electric Illuminating Company of Boston is preparing to install a primary network in the Brookline-Brighton district along the lines described by A. H. Sweetnam in the ELECTRICAL WORLD, March 14, 1931, the vault construction having advanced to a point where the assembly of General Electric equipment comprising a standard 1,500-kva. transformer and auxiliary apparatus will shortly be placed underground and connected with the Edison transmission lines. The space economies of the assembly are indicated by the accompanying illustrations of a typical Brookline vault as it will appear upon completion of the work. The over-all maximum dimensions of the vault are 39 ft. 4 in. long x 13 ft. 4 in. wide x 14 ft. high, giving an envelope volume of 7,350 cu.ft., or 4.9 cu.ft. per kilowatt-ampere of transformer capacity.

The equipment is to be of the totally inclosed metal-clad type, designed for waterproof operation and with provision for tap changing under load. A control pedestal will be mounted at the surface of the ground above the vault. Motor-driven fan ventilation will be provided, and in case of an overheated atmosphere within the vault, fusible links will insure the closing of discharge louvers, thus stifling interior drafts capable of developing fires. The 13.8-kv. cables will enter the vault at the end nearest the transformer and



Typical 1,500-kva. primary network unit

Illustrating the compactness of assembly and rugged characteristics valuable in this class of construction. The Boston unit differs in minor particulars from this design.

short inclosed connections will be carried out of the transformer into the oil circuit breaker section of the assembly. Four 4-kv. feeder breakers will be provided in addition to a breaker in the transformer secondary connections. At the further end of the vault will be the control cabinet containing various relays and other auxiliary equipment. In addition to a manhole for the operating force's use, two large manholes for the handling of equipment parts are provided.

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Electrical Growth Unlimited if Control Remains Private*

By J. S. TRITLE
Vice-President and General Manager
Westinghouse Electric & Manufacturing Company

Back in 1921 there was an opinion that saturation in the electrical industry had been approached and that future growth would be slow. In the light of the developments in the last decade—an increase in electric consumption of almost 150 per cent—that viewpoint seems ridiculous.

Looking ahead for possible new applications for electricity, we hear rumors that the china and pottery industry is going to be revolutionized by means of a complete electrical and mechanical process of production. The old-established dairy industry is working out an electrical process for pasteurization. The metal industry is demanding new alloys produced in the electric furnace. From behind the doors of chemical process plants come reports of new developments that are tied in with further electrification. The steel industry is finding a new method of heat treating in electric furnaces that brings better results. The coal industry is installing electrically operated door openers, actuated by the light-sensitive relay or "electric eye." The petroleum industry is drilling with electrified rigs transporting through electrically welded pipe lines and pumping gasoline into your car by electric pumps.

New era of expansion

It seems safe to assume that history will repeat itself, and that we are now entering another era of electrical expansion that will put the last decade to shame. The record of the industry during the present year seems to bear out that conclusion. Electric power consumption for the first six months of this year was only 4.3 per cent less than the same period in 1930, and only 1.4 per cent less than in 1929, when industrial activity was high. There will be but little ground to recover before new records will be set.

That the industry's income has not fallen off in proportion to the consumption (0.8 per cent below 1930 and 4.3 per cent above 1929) is a feather in the hat of power company engineers.

But there is still another problem, which we must face squarely if we are to protect the investment in, and promote the further expansion of, this tremendous electrical industry. And that is the threat of government ownership and operation.

The government control menace

In an address delivered in Washington in 1924 by Herbert Hoover when he was Secretary of Commerce he made the following comments with reference to the proposal for government ownership and operation of railroads, electric railways, power, light, telephone and telegraph services:

"In its immediate form this is a proposition that the government should buy and run the railways, electrical and other utilities, valued by official commissions at about forty billions of dollars, with 2,700,000 employees, requiring two billions annually for bond interest, with an operating budget of ten billions per annum. To keep pace with natural growth these concerns must spend two billions of new capital yearly for extensions. This is a financial transaction and a venture into business of a magnitude never before undertaken by any man or by any goverment, democratic or otherwise—except in Russia. Surely before we embark on such a voyage we should look into the possibility of profit, examine the chart of the place where we are going, and consider the capacity of our vessel to carry the cargo.

"It is for the American people to decide. If they are to decide rightly, they should have the reasons set before them in terms of sober economic and social thought, not in vituperation and appeals to hate. I accredit the sincerity of the advocates of these propositions, and I believe they have the manhood to credit ours. There is but one consideration—public interest. If I believed for one moment that this adventure would reduce rates, that it would produce better service, that it would decrease taxes, that it would benefit the employees, that it would maintain discovery initiative and advance in the development of these services, that it would not wreck our democracy, that it would strengthen the foundations of social and spiritual progress in America, or even that it would do a few of these things, I would unhesitatingly accept this proposal, stupendous as it is.

"But I do not believe it. I am convinced, not only from the experience of our own country, but from the attempts made abroad, that government operation is a step backward in every one of these propositions. It is the negation of progress. America has found the true road of advancement in these enterprises through sustained initiative and equality of opportunity to our people, with public control to prevent abuse. Our salvation consists in following this line with increasing intelligence and devotion."

This exactly expresses my views on the subject.

But we must not leave this matter in the hands of a few advocates, powerful though they be. We must each one of us and all of us unite to keep the heavy hand of government out of the affairs of our great utilities except for equitable supervisory power, by creating a public sentiment that will make itself felt at the very seat of government so forcibly that vote-seeking politicians will not dare to usurp the right of our utilities to life, healthy growth and prosperity guaranteed every one under our constitution.

**From address presented before St. Louis Electrical Board of Trade.*

Sixteen Months to Recover with Inducement Rate

RATE reductions for residential service usually have been made for one of two reasons—either the earnings from this class of service have grown favorably and thus justified a decrease in rate or else the rate is deliberately lowered in an effort to build up consumption and revenue from the average customer so an adequate return can be earned on investment allocated to him. In either case there is much less uncertainty about the immediate consequences than about the subsequent trends of consumption and revenue. Experience in typical cases has shown that a judicious framing of a new rate and the use of service or initial charges will result in a recovery within sixteen months of the previous annual revenue per customer and in 24 months the value will have risen to the desirable trend curve which was not being sustained by the previous non-inducement rate.

Incidental to the main objective there are certain other features which are advantageous adjuncts of the shift to a substantial flat charge and rapidly tapering block rate. Not only does it mean a considerably lower energy rate but it also offers the opportunity of eliminating extra meters for bulk uses. It encourages additional use in every month of the year, not merely in the heavy consumption months. It does away with high top rates and the resulting disagreeable comparisons between the one cent or less at the switchboard and 8 cents to the customer. It tends to narrow the spread between summer and winter bills and thus minimizes the flood of inquiries that attend the rising autumn charges, especially where the October bill emphasizes the passing of daylight saving time. It will also ease the path of the utility when a more efficient type of lamp is perfected and introduced.

Twelve-month continuous index best

These attributes are ordinarily recognized in contemplation of a change and some estimate can also be made of the extent to which an appliance sales campaign will be instrumental in popularizing the real significance of the rate. But when all is said and done there is a considerable element of gambling on the amount of revenue to be derived in subsequent months. Here experience on the part of those who have made the experiment is a reliable index.

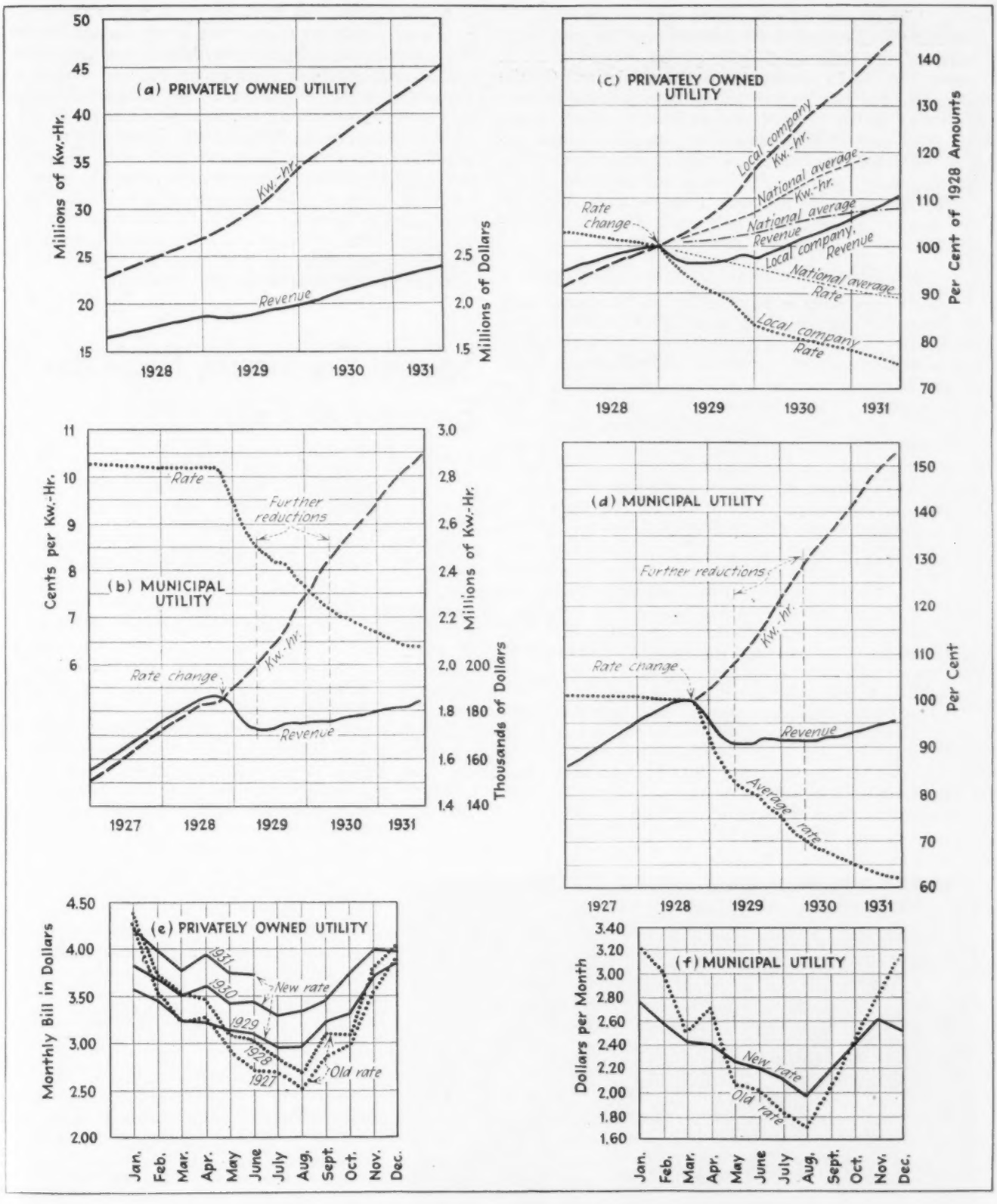
Often these experiences are set up on a month-by-month basis. This, however, is likely to be misleading as an indication of the progressive consequences of the new rate. Regardless of the season in which it is instituted there are likely to be sharp departures in some cases and these may cast doubt on the wisdom of the move. The substitution of a service charge type of rate for an ordinary block rate causes substantial cuts in revenue in the winter months, which are partly offset by increases in the summer months. In other cases the continuous scheme of meter readings obscures the results for several weeks. From the long-range viewpoint the significant index is obtained from the plot of a twelve-month continuous value of kilowatt-hours and revenue against a current rate, whether it be for the total values or on a per-customer basis. Admittedly the experience month by month is of value for monthly accounting purposes. But in analyzing the effect of a rate change the progressive twelve-month data are a safer barometer of trends.

Revenue slowed up under block rate

Such an analysis has been made of a large operating property in which output and revenue were growing moderately under a block rate which tapered from 8 cents for the first 100 kw.-hr. to 4½ cents for the excess over 500. Evidently only the larger user could derive advantage from the lower follow-on energy rates. In this instance there were separate rates for cooking (3 cents with a $1.50 minimum) and refrigeration (5.4 cents for the first 100 kw.-hr. and minimum bill $2). In the last twelve months of its application the revenue per customer was $40. Under it also the monthly bills varied from $2.68 in August to $4.39 in January, a difference of 64 per cent.

In the middle of the period shown in the diagrams a new rate was instituted. It included a $1 flat charge with energy rates of 5 cents for the first 50 kw.-hr., 3 cents for the next 150 and 2 cents for the excess. This rate meant a cut of 16 per cent in residence revenue and the gross receipts naturally slumped considerably on a monthly basis, but, set up as a twelve-months item, the dip was slight and was quickly balanced by new revenue from additional customers and increased sales to present customers, so the total gross revenue was recouped in less than six months. The dip in revenue per customer was more noticeable, but was offset by increased sales, so that the maximum decrease at any one time was only 4 per cent on an annual basis. In sixteen months the revenue per customer had again reached its previous figure and in 30 months it had resumed its place on the previous trend curve and was growing at a faster rate than before, in spite of the depression.

In the first 2½ years under the new rate the annual sales increased 68 per cent and the annual revenue grew 32 per cent. The annual sales per customer increased 45 per cent and the annual revenue per customer 11 per



Effect of inducement rate on residential revenue

(a and b) Kilowatt-hour consumption rises promptly after adoption of inducement rate. Gross revenue from residential business drops snarply, but recovers gradually. Each point represents summarized value for preceding twelve months and not individual monthly values.

(c and d) Revenue per customer takes longer to recover than gross revenue because of increased number of customers contributing to the gross. Use rises sharply. Twelve-month totals for revenue and energy.

(e and f) Inducement rate materially reduces monthly variation in average bill per customer. Initial charge a more important contributing factor than equalized use.

cent. The original rate reduction was 16 per cent, but the customers earned a further decrease by reason of increased use until the 2½-year period showed a cut in average rate of 25 per cent below the old figure. On the whole, the justification for the new rate is found in comparisons with the national average figures. The revenue per customer, already above the annual average, increased 11 per cent, while the national figure was going up less than 9 per cent, following the adoption of the inducement rate. At the same time the average earned rate dropped almost 25 per cent, while the national average was decreasing slightly more than 10 per cent.

Municipal plant recovers revenue quickly

Similar experience is reported by the municipal plant at Norwich, Conn., in which instance it was felt that the receipts from the existing 10-cent rate had been too high and a reduction should be made. On October 1, 1928, an initial charge rate was adopted. It consisted of a charge of $1.35 for the first three rooms (including 5 kw.-hr.) plus 10 cents for each additional room, with all energy beyond the first 5 kw.-hr. at 3 cents. Motors and refrigerators occasioned an additional assessment of 50 cents or more, depending on the rating. Revenue dropped and consumption increased, but the decrease in revenue was not as much as was intended, therefore a further decrease was instituted. The initial charge was, on May 1, 1929, made $1 for the first three rooms plus 15 cents per room for each of the next seven rooms and 10 cents per room on all over ten rooms. The motor and refrigerator charge was retained. The bulk of the cut in this case was given to the small home. Consumption and revenue increased, both in total and per customer, and still the revenue was larger than desired.

A year later a third decrease was made by reducing the initial charge to 90 cents and allowing a 5 per cent discount on the whole bill for prompt payment. Again the consumption and revenue, total and per customer, show a rising tendency with a steady drop in average kilowatt-hour cost from over 10 cents to less than 6.5 cents.

A striking result of the inducement rate is the leveling of monthly bills and its direct effect on quelling the rising tide of inquiries and complaints when the October and November bills so much exceed those of August and September under a straight energy charge. Here the old spread from August to January was from $1.72 to $3.24, a difference of 80 per cent. Under the new rate the increase from summer to winter is only 40 per cent as a result of diluting the energy component by means of an initial charge. The customer who is billed only 35 cents more in December than in September is very likely to take a liberal attitude toward the use of those energy-consuming conveniences that pave the way to needed increase in return on distribution dollars.

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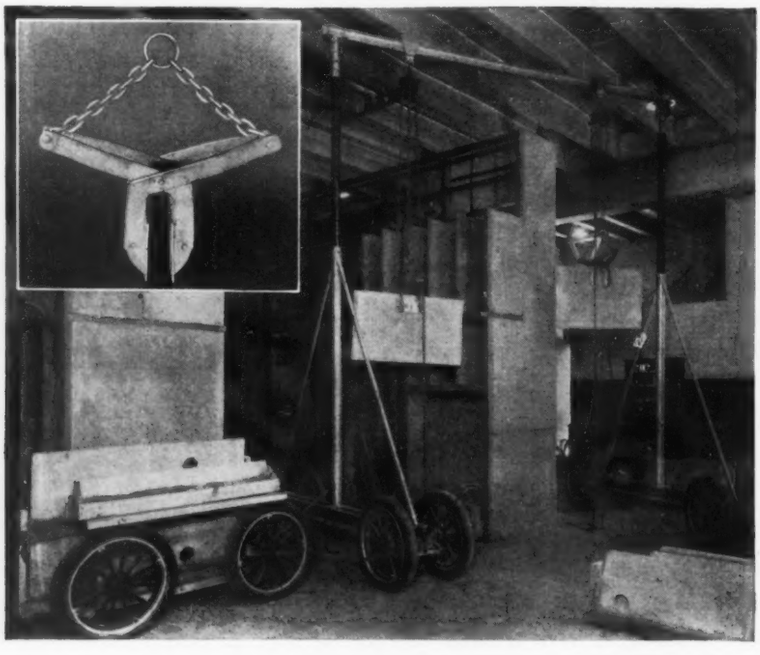
Special Equipment Facilitates Erection of Cells

By J. E. BUSHER

Superintendent of Station Construction
Kansas City Power & Light Company

Erection of the Alberene stone bus structures in substation H of the Kansas City Power & Light Company was speeded up and made easier work by using the home-made crane, clamps and buggy shown in the accompanying illustration. There was a total amount of 320,726 lb. of stone used in these bus structures. The average dimensions of the stones were 2 in. thick by several feet square, and in some cases they weighed as much as 860 lb. each.

The ordinary way in which stone slabs are installed in a bus structure of this nature is to drill a hole somewhere near the center of the slab and insert a bolt around which a cable sling is hooked. A rope and falls are then used with an A-frame to hoist the stone into place.



Barrier handling equipment is flexible

For the crane four front axles and four pairs of pneumatic-tired wheels were used. A pair of wheels is fastened to each end of two 6-in. channel irons. On this was mounted a pipe framework consisting of 3½-in. pipe telescoped by a 3-in. tube. This supports a 4-in. I-beam carrying two half-ton chain falls which run on trolleys along the beam. This crane is adjustable in height from 10 to 18 ft. and in width up to a 14-ft. span. It can be guided from either end. Instead of being used with the trucks opposite each other as the illustration shows, either end may be swung around so that one truck will follow the other.

Two pairs of wheels and two front axles were used for the cart shown in the lower left of the picture. The axles were cut in the center and dropped to allow the stone to slide in between the wheels in an upright position. Before the stone is placed in the cart the top half of the crate is removed so that the stone may be lifted out of the crate by means of the tongs on the end of the chain falls, a detail of which is shown.

It was obvious from the start that with $1.50 an hour labor this method would run our construction cost very high, so a very flexible sort of a crane with some properly designed clamps was used to erect these stones. It was possible with the use of this crane and clamps to pick up the stone and spot it in its place without it ever being touched by hand. As the structure was 17 ft. high it can be readily seen that this was quite a saving over the scaffolding method. We were also confronted by the problem of protecting a tile floor. This was done by the use of old Ford wheels and tires on the crane and buggy.

During the construction of the structure no piece of stone ever slipped in the clamps. No tile was broken in the floor and no accident or injury occurred. From our calculations on other jobs, where other methods were used, we find that this method effected quite a saving in money. Furthermore, the accident hazards would be to a minimum.

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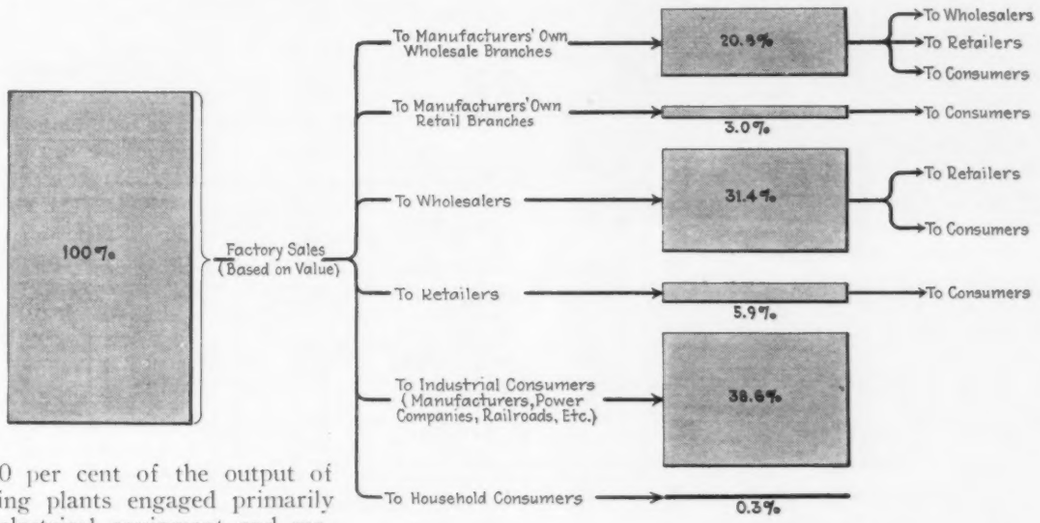
Industrial Consumers Take Third of Electrical Products



Nearly 40 per cent of the output of manufacturing plants engaged primarily in making electrical equipment and machinery is sold to industrial consumers such as manufacturers, power companies and railroads. This is the finding of the Department of Commerce in a highly informative survey of 1929 business just completed.

How the distribution of electrical products was effected through the various channels has been carefully worked out. The total referred to was 38.6 per cent, or $859,957,000 out of a grand total for the year of $2,230,361,000. The next largest share, 31.4 per cent, was sold to wholesalers, 5.9 per cent to retailers, 3 per cent to manufacturers' own retail branches and 0.3 per cent to household consumers. Manufacturers sold 20.8 per cent to their own wholesale branches. Of the above sales, except those to manufacturers' own sales branches or to household consumers, $143,726,000 was made through manufacturers' agents, selling agents, brokers or commission houses. Sales were made through such agents by 428 manufacturing plants, 81 of which sold their entire output in this way.

In its distribution study the department worked out separate tabulations covering the various channels. Of the eleven such tables, the accompanying three are of particular interest. They show, respectively, total distribution by classes, sale of switchboards, circuit breakers and switches, and the sale of fuses. The study, incidentally, does not cover plants whose principal products are electric lighting fixtures, electric signs or motor-driven tools, mechanical refrigerators, washing machines and other machines and appliances constructed with built-in motors. These are classified, for census purposes, in other industries.

Distribution of Sales, 1929

	Selling Value (f.o.b. factory)	Per Cent of Sales	—Number of Plants— Total	Selling Exclusively as Indicated
Total	$2,230,361,000	100.0	17.76	..
Sales to manufacturers' own wholesale branches	464,148,000	20.8	216	73
Sales to manufacturers' own retail branches	67,762,000	3.0	49	..
Sales to dealers:				
Wholesalers	700,333,000	31.4	963	370
Retailers	131,033,000	5.9	517	94
Sales to consumers:				
Industrial (manufacturers, power companies, railroads, etc.)	859,957,000	38.6	857	381
Household	7,128,000	0.3	212	46

Switchboards, Circuit Breakers and Switches

	Selling Value (f.o.b. factory)	Per Cent of Sales	—Number of Plants— Total	Selling Exclusively as Indicated
Total	$39,792,000*	100.0	55	...
Sales to dealers:				
Wholesalers, including manufacturers' own wholesale branches	6,078,000	15.3	25	11
Retailers	346,000	0.9	8	...
Sales to industrial consumers	33,368,000	83.8	42	25

Fuses

	Selling Value (f.o.b. factory)	Per Cent of Sales	—Number of Plants— Total	Selling Exclusively as Indicated
Total	$6,311,000*	100.0	14	...
Sales to dealers:				
Wholesalers	5,500,000	87.1	12	6
Sales to industrial consumers	811,000	12.9	8	2

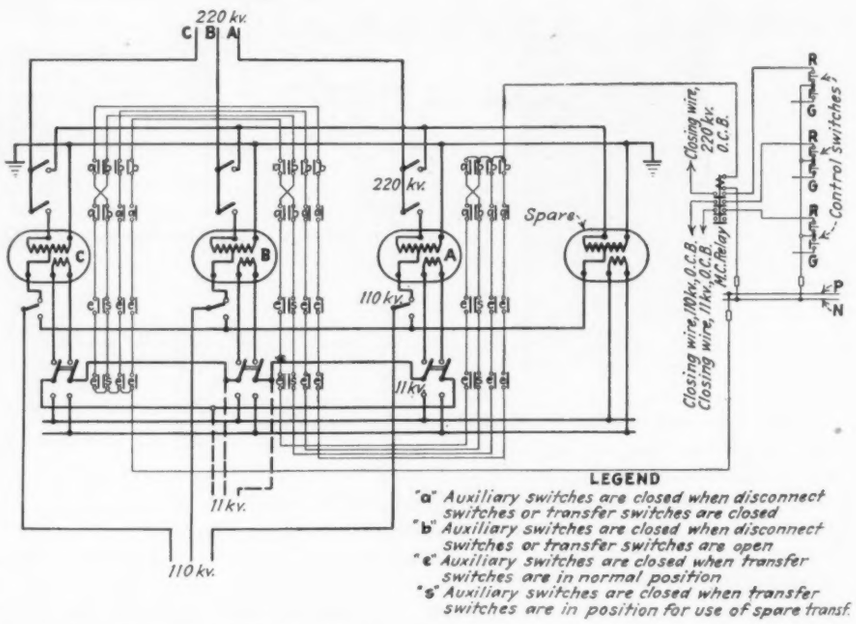
Interlocked Switches Cut in 220-Kv. Spare Transformer

By E. F. MARYATT

Assistant Engineer
Pacific Gas & Electric Company, San Francisco, Calif.

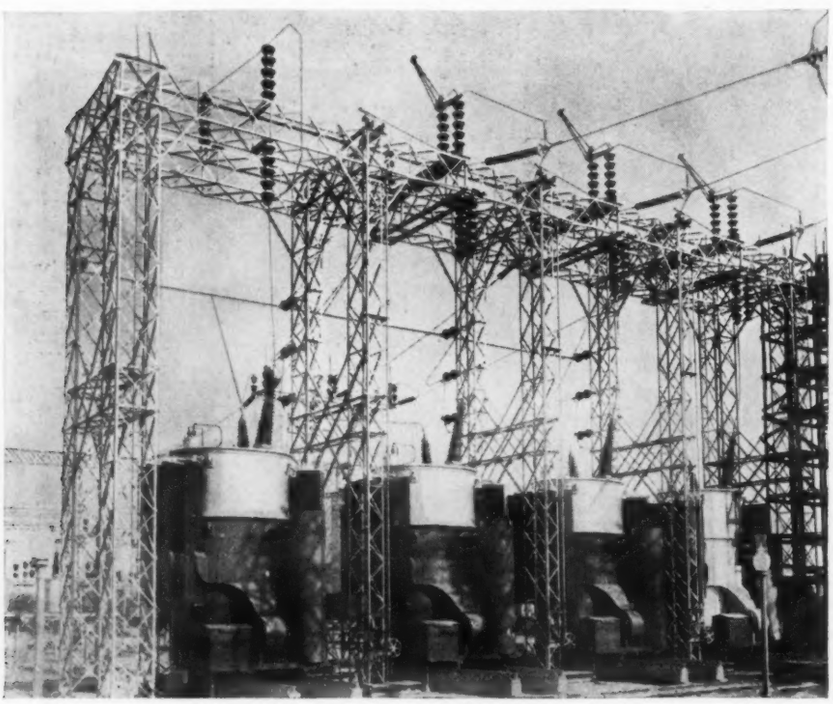
ADVANTAGES of Y-Y transformers for transmission and distribution, especially at the higher voltages, 100 kv. and above, are responsible for their rapid gain in favor. There are, however, certain disadvantages, principally the fact that major banks must consist of four single-phase transformers to insure a reasonable continuity of service. Three constitute the bank and the fourth is reserve for use in the event of failure of one of the three transformers in service. It is standard practice of the Pacific Gas & Electric Company to equip all such banks, up to and including 100 kv. primary, with switches and bus structure to permit a means of conveniently and quickly disconnecting the faulty transformer and cutting in the spare without the necessity of making any physical movement of the transformer.

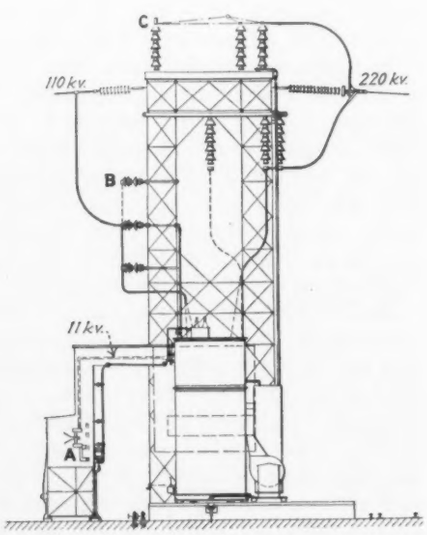
Physical dimensions of high-voltage air-break switches, combined with the large voltage clearance requirements, have heretofore prevented the equipping of 220-kv.



Interlock connections to prevent error in transfer switching on 220/110/11-kv. transformer bank

Transfer switches may be identified by reference to the accompanying drawing





End elevation of switch structure showing switching arrangement for cutting in spare 220-kv. transformer

banks with transfer switching facilities. To replace a faulty transformer without this equipment it is, of course, necessary to disconnect the faulty transformer by hand, physically move it out of its position in the bank, lift it off the transfer car, move the spare transformer into the space vacated and by hand make up the necessary bus connections. This process involves the moving of two pieces of equipment, each weighing somewhere between 50 and 100 tons, and the time consumed is at least two or three hours.

The latest installation of a 220-kv. bank on this company's system has, however, been equipped with complete transfer switch equipment and also control interlocks to prevent any possible damage to the bank through errors in switching. This bank consists of four 25,000-kva., single-phase transformers stepping down from 220 kv. Y to 110 kv. Y and 11 kv. delta, and was recently placed in service at Herndon, near Fresno, Calif., for the interchange of power between the Pacific Gas and San Joaquin systems. The arrangement of switches is shown in the accompanying end elevation of the bank.

The 11-kv. transfer is effected by a gang-operated, double-throw switch. The 11-kv. windings of the transformers are connected in delta and therefore require a double-pole switch for transfer. The 110-kv. transfer is effected by a single-pole, double-throw switch, mounted on a rotating insulator and operating through approximately 180 deg. by means of a gear reduction device. The 220-kv. transfer is handled by two independent switches; one, of the blade type, connects the line to the spare transformer bus, and the other, of the roller or dolly type, disconnects the line from the defective transformer.

The spare transformer buses are shown at A, which is the 11-kv.; B, which is 110 kv., and C, which is 220 kv. Only four switch operations are necessary to effect a transfer. However, if a number of the transfer switches have been operated, it is necessary, before the bank is again energized, to check the position of twelve switches. As may be seen, it would be possible, with improper switching set-up, to leave the line or a transformer winding shorted. To insure that the check has been made correctly and that the proper set-up of all transfer switches exists before the bank is cut into service an interlock was provided making it impossible to close any of the bank oil circuit breakers unless the switches are all in their proper relation.

A simplified diagram of this interlock is here shown. The conditions to be fulfilled in effecting this interlock are four in number. All transfer switches for any one of the three transformers must be connected to the spare transformer buses at the same time the two other sets of transfer switches are in their normal position. The fourth condition is that all transfer switches must be in the normal position. Four wires in multiple are run individually through a set of auxiliary switches attached to each of the transfer switch mechanisms. If the transfer switch positions line up correctly, one, and only one, of the four wires will form a continuous circuit through the coil of the normally energized auxiliary relay, whose contacts, if closed, permit the closing of the 11-kv., 110-kv. and 220-kv. oil circuit breakers. It is obvious that if there is no circuit to the auxiliary relay, its contacts will be open and prevent the completion of the closing control circuit to the oil circuit breakers, and the bank cannot be energized.

This is just one more step toward making operation less nerve wracking and toward the safeguarding of large sums of capital investment.

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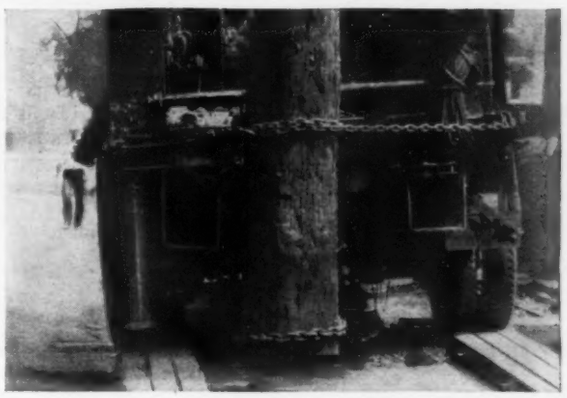
Moves 70-Ft. Pole Carrying Circuits



To make way for a street-widening project it was necessary to move several feet a 70-ft. pole carrying two 23-kv. circuits and primary and secondary leads. The pole was to be moved in the line of the lead and the job thus consisted of moving the butt to the new location and then straightening the pole in the lead. As shown in one of the accompanying illustrations the truck was backed up to the pole and the upper chain set securely in place. The lower chain was then looped around the bottom of the pole and an upward strain put on it by means of a rope up over the tail of the truck and to the winch mounted on the forward part of the body. Then the pole was sawed off at the ground line, lifted a couple of inches by the winch and moved to the new point, where a foundation for a pair of Williams pole mounts had been prepared.

Range-Design Trend Aids Utility Service

By F. R. LAWS
Edison Electric Illuminating Company of Boston

Proper grouping of units essential. Better load balancing helpful. Manufacturers co-operating for improved regulation.

RENDERING adequate service to the modern electric range has been made very much easier by the development of automatic load balancing. As a result of better load balance faster and more uniform heating is obtained. That so simple a thing as the method of wiring an electric range should have a marked effect on the distribution system serving may at first seem strange. Such, however, is the case.

From a study of a large number of the older ranges it appears to have been standard or common practice to connect the heating units of certain models (regardless of the various capacities) so that the two oven units were balanced against three, four or more of the surface-plate units.

Oven-surface plate balance objectionable

This type may be described as the "oven against surface-plate unit" plan of balance. See range diagrams for types I, II and III on page 1091.

From extensive observation it has been our experience that for average secondary network conditions and, further, on account of every range owner's desire for quick heating this plan is unwise and very undesirable, as all the range units may not be in use every time the range is required, or similar units may not be used which are connected on opposite sides of the three-wire system. This procedure upsets load balance and tends to produce unsatisfactory voltage values to each unit during the time of use.

Frequently during the daily requirements for the use of a range both the oven units or all surface plates may be used separately or as unit groups.

It is obvious that a voltage unbalance will exist at the range bus, due to the excess "current draw" on one of the sides of the three-wire system, the lower voltage being maintained at the units in use, resulting in slow heating. This is quickly sensed by the average housewife, and, unfortunately, just at the time when normal voltage is required to accomplish the heating and cooking in a satisfactory time.

The accompanying charts of comparative voltage values taken at the service entrance switch, and observed by turning on the range switch of the individual and combinations of units to "high-heat" position, show that this type of unit balance is the type most likely to cause dissatisfaction and complaints of slow heating. It is also largely responsible for complaints of other customers whose service wires happen to be connected to the same side of the three-wire system as that of the range oven, or surface-plate units.

At the time either of these combinations of the range is in use it may result in dimming of the general lighting in neighborhood houses.

In cases where this type of range is used in a locality that is serviced by large capacity secondary mains, commonly used in medium- and large-sized secondary networks, or in large apartment houses and other buildings where an electric range is the only means of cooking, the same operating conditions do not prevail as experienced in the smaller networks.

Where service is supplied by large-sized secondary mains, either by a d.c. network, or, in the case of a.c., by a suitable capacity transformer located at, or not far from, the building, the large capacity supply cable is capable of supporting the heavy "current draw" on either side of the three-wire service, without appreciable loss in voltage at the range unit terminals.

Complaints of poor service, of course, under these conditions are rare.

Advantages of alternated-unit load balancing

There is another and similar type of range in use, having what may be described as the "alternated-unit plan" of load balance.

This design of load balance permits a better voltage balance and maintenance of a higher voltage value at the unit or units when in use, hence giving rise to fewer complaints. This plan of load balance is undoubtedly still in use extensively over the territory of many utility companies. These installations are better adapted for "servicing" from a company's average network installations.

Each surface-plate unit on one side of the 115-volt system is balanced by another and similar unit on the opposite side of the 115/230-volt system. The top and bottom oven units are also balanced across the three-wire system.

The odd number unit (if the particular range has one) is connected across the side having the lesser connected load, thus arranging the capacity of the units to make a more satisfactory load balance on the range with all units in use.

Types IV and V show a comparison of voltage values observed with different combinations of range units in use at the time of complaint investigations, and it will be noted that practically any combination of units may be used, as the operator has a choice of any surface-plate unit and is thus able to obtain a more satisfactory voltage balance when the heating elements are used in multiples of two units, and even in the case where two units against three are in use a higher and more satisfactory voltage value is maintained at each unit.

The housewife is thus able more nearly to secure the quick-heating-time period desired and demanded by every range user, hence fewer complaints of poor service are referred to the company for investigation.

Another phase of this problem for company and customer is the existing service wire size on pole line construction on private property ways.

To supply satisfactory service voltage conditions to all customers is one of the requirements exacted of electric light and power companies, but difficulties are often encountered by conditions created in earlier years and over which a company now has no control.

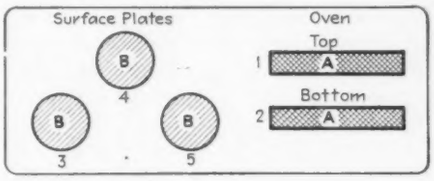
These conditions refer principally to the large number of customers who have installed ranges in recent years and who reside on an estate having private property pole line construction extending in from the main street a distance of two to eight spans (225 to 1,000 ft.) of small secondary wires.

Cases have been brought to our attention by customers having the type of range first described (the surface-plate versus oven-units balance) complaining of unsatisfactory operation due to a prolonged heating period. The customers naturally assume the cause to be "poor service conditions" supplied by the utility company.

Included in this list are cases where several customers and range owners reside on the same estate, using the

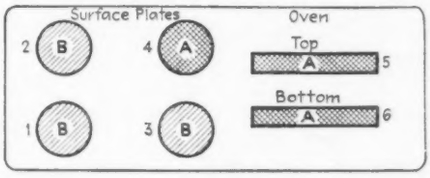
Type I (7 Kw., 106-114 V.)

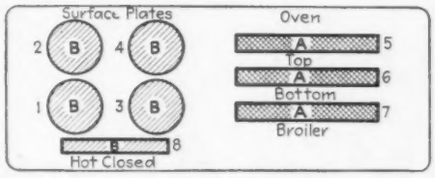
	A	B		A	B
No-load voltage	116	116	3	116.5	113
1 Switch on			4	116	112.5
high	111	117	5	117	111
2	110	118	1 + 2	106	118
			3 + 4 + 5	118	105

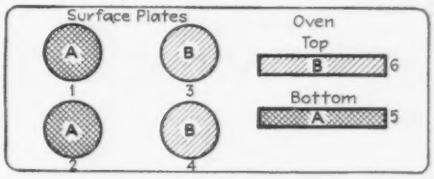


Voltage regulation* of range types

Observed voltage regulation at three-wire leads from service switch corresponding to various heating unit connections. Types I, II and III have oven vs. plate balancing, types IV and V have alternated-unit load balancing and types VI and VII are equipped for automatic load balancing. The best regulation is obtained with types VI and VII.







Type II (7 Kw., 100-125 V.)

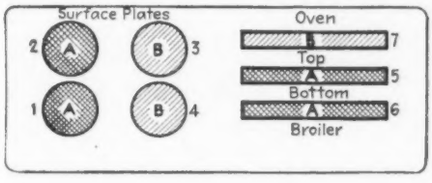
	A	B		A	B
No-load voltage	116	116	5	118	107
1 Switch on high	108	118	6	118	107
2	108	118	1+2+3	98	118
3	111	117	4+5+6	120	97
4	118	109	5+6	119	101

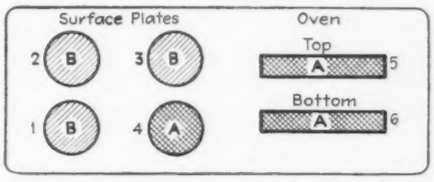
Type III

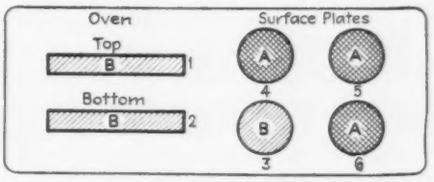
	A	B		A	B
No-load voltage	116	116	7	112	115
1 Switch on			8	116	112
high	117	109	1+2	118	106
2	117	109	1+2+3	119	102
3	117	109	1+2+3+4	119.5	97
4	117	108	5+6	106	116.5
5	109	117	1+2+5+6	108	116.5
6	108	117	5+6+7	99	120

Type IV (6.5 Kw.)

	A	B		A	B
No-load voltage	116	116	5	112	117
1 Switch on high	113	118	6	119	110
2	110	118	1+4	113	114
3	118	113	1+4+5+6	113	111
4	118	113	5+6	112	111







Type V (9 Kw.)

	A	B		A	B
No-load voltage	116	116	5	114	117
1 Switch on high	116	114.5	6	117	114
2	116.5	114.5	7	114.5	117
3	114	117	1+2+5+6	113	114
4	114	117	5+6	115	115

Type VI (9.56 Kw., 220-110 V.)

	High		Medium	
	A	B	A	B
No-load voltage	116	116	116	116
1 Switch on	114	115	117	114.5
2	114.5	115.5	117	115
3	113	114.5	117.5	112.5
4	114	115.5	112.5	116.5
5	113	115	110	117.5
6	113	115	110	117.5
1+2+3	110	114	118	109
5+6	110	112.5	109	119
4+5+6	108	114	106	120

Type VII (9.5 Kw.)

	High		Medium	
	A	B	A	B
No-load voltage	116	116	116	116
1 Switch on	114	114.5	118	114
2	114	114.5	118	114
3	114	114	117.5	113.5
4	114	114	115	117
5	113.5	114	115	117
6	114	113.5	115	117
1+2	113	113.5	118	111
1+2+3	110	111	119	110
5+6	113	112.5	112.5	117
4+5+6	111	111	110	118
Total range on high	107	107		

*Figures in left-hand column of each group indicate unit connected. Figures under columns A and B show voltages on these circuits with loading indicated at left.

same private property secondary mains, and have been complainants individually and collectively from the same cause, namely, excessive-voltage loss from transformer to range when various combinations of units are in use.

In such circumstances the only assistance the company can offer (having outside construction in mind) is an investigation of service voltage conditions to assure the customer that the company does maintain standard voltage at the secondary terminals of the company's transformer, which is located as close to the private property line as possible, and a recommendation as to desirable changes in the private property line.

Sometimes these customers consider the cost of wire size changes and probable pole line reconstruction prohibitive, and thus the company may lose revenue from this very desirable class of service.

Where the "load-balance" range aids regulation

These and similar difficulties have led to the development of the modern load balance range. This is designed to preserve automatically a more uniform load and voltage balance regardless of the combination of heating elements in use and is accomplished by the use of a special switch connected to each heating unit.

The "hook-up" is so arranged that when the heating unit is switched to "high-heat" position the two 110-volt coils are connected in series across the 230-volt bus of the range.

When "medium heat" is required one coil only is connected across the 115-volt bus, and when on "low heat" the two 110-volt coils are connected in series, also across the 115-volt side of the three-wire system.

This type of range greatly reduces the variable voltage condition at both range and service switch, eliminates practically all the troubles encountered in the type of load-balance range above described and is well adapted to all commercial circuits with average secondary wire-size copper conditions.

In support of this view type VI shows a voltage test taken on this type of range under similar private property construction as above, located at the end of three No. 4 secondary wires about 800 ft. from the transformer.

This range had been in use for two years without complaint of poor range performance with reference to low-service voltage, which we venture to say would not have been the case with any other method of load-balance range.

▼ ▼ ▼

What Do Losses Make Apparatus Cost?

By C. W. GUYOTT
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The seeming paradox often arises in which it is quite possible to secure a bid on electrical apparatus the total losses and price of which are lower than those of competitive bids and yet the apparatus is more costly to buy under certain conditions.

These conditions arise frequently with normal applications so that intelligent selection among bids makes necessary some procedure of capitalizing losses. The usual procedure of substituting a number of variables in capitalization equations becomes cumbersome when numerous comparisons are made and the work is subject to error. It is the purpose of the following material to suggest a simplified mode of procedure which, when set up, is capable of quick comparison.

Let:

K_N = Capitalized value of one year's no-load losses in apparatus per kilowatt of loss.
K_L = Capitalized value of one year's load losses in apparatus per kilowatt of loss.
C = Cost of power at terminals of apparatus in dollars per kilowatt-hour.
H_C = Hours in year apparatus will be connected.
H_L = Hours in year apparatus will be loaded.
F = Ratio of average load on apparatus while in service to rated load.
M = Fixed charges chargeable to the apparatus and which includes interest charges, depreciation, taxes and insurances. Expressed in decimal form.

Since no-load losses will be constant for the time the apparatus is connected, we can write:

$$MK_N = CH_C$$

$$K_N = \frac{C}{M} H_C \quad \ldots\ldots (1)$$

Also, since load losses vary as the square of the load

$$MK_L = CH_LF^2$$

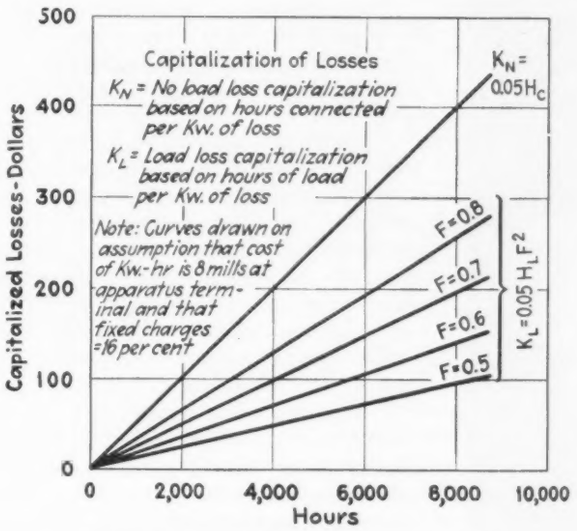
$$K_L = \frac{C}{M} H_LF^2 \quad \ldots\ldots (2)$$

The use of F in the above sense is partially inexact, since it is not a true effective value. The justification for its use is, however, practical, since the apparatus under consideration is to be purchased and actual load curves are not available. Thus the securing of effective or average values is based on a matter of judgment. The majority of load curves have a form factor so nearly unity that the error in using average rather than effective values is no greater than the error involved in solving for effective values on an assumed load curve. In view of the above, average values—i.e., load factor—are used for practical computation because load factor tables are available and commonly in use and serve as a basis for estimating F for all classes of businesses, applications, etc. The errors involved in the

above and following assumptions are small, and since the material is used for comparison purposes, errors will not affect "differences in costs" of the apparatus under comparison.

Certain factors constant for given company

As a result of widely different applications to which even the same apparatus can be put, it is obvious that H_C, H_L and F will vary greatly, so that the result of assigning approximate value to them, to be considered as constants for all cases, will result in considerable misjudgment. However, for any given system, plant or organization, the value of C and M will be fairly constant, so that equations (1) and (2) will be of the forms:



Annual Losses Capitalized an element of initial outlay

$K_N = kx$, which is the equation of a straight line and $K_L = k\,xy^2$, which, if y is assigned a series of fixed values, becomes an equation expressing a family of straight lines.

In order to illustrate the application of the above idea, let us assume an organization where the cost of power is \$0.008 per kilowatt-hour and the fixed charges are 16 per cent per year.

$$\text{Then } \frac{C}{M} = \frac{0.008}{0.16} = 0.05$$

Due to the magnitude of other quantities involved and the position of $\frac{C}{M}$ in the equations, slight errors in selecting C and M will not result in prominent distortion of comparative cost. Then:

$$K_N = H_C\ (0.05) \qquad (1)$$

The above equation can be plotted by assigning some value to H_C and solving for K_N. Since the line must pass through the origin, only one other point is needed to draw the straight line.

Also in the case of $K_L = 0.05\ H_L F^2$
let $F = 0.8$
and $K_L = 0.032\ H_L$

The above equation is plotted just as is (1), only one point other than the origin being needed. Similar equations can be obtained by letting $F = 1$, $F = 0.7$, $F = 0.5$, etc. Usually values of F below 0.1 will not be needed.

With the value of C and M selected to suit a purchasing organization and curves plotted as above, the actual cost of energy losses is readily determined not only for single units but combinations of apparatus as well.

The accompanying graph is an illustration of carrying out the above procedure. Using this chart, it is interesting to see in a practical illustration what motor among an offered three is really the best to buy for a particular job in an organization where the motor will be loaded 2,000 hours in a year and connected for 4,800 hours in the year. It is also estimated that the average load factor $(F) = 0.5$.

Motor	No Load Loss	Loss at Rated Load	Total Loss	Installed Price
No. 1 Motor	51.2	94.2	145.4	\$12,350
No. 2 Motor	46.0	100.0	146.0	\$12,400
No. 3 Motor	43.1	102.9	146.0	\$12,500

From the chart K_N = \$240 and K_L = \$25.
Then:
For No. 1 motor:
Total no-load loss capitalization = 51.2 × \$240 = \$12,300
Total load loss capitalization = 94.2 × \$25 = \$2,350
Total yearly loss, capitalized = \$14,650
Price of motor = \$12,350
True initial cost of No. 1 motor = \$27,000
For No. 2 motor:
Total no-load loss capitalization = 46.0 × \$240 = \$11,050
Toltal load loss capitalization = 100 × \$25 = \$2,500
Total yearly loss, capitalized = \$13,550
Price of motor = \$12,400
True initial cost of No. 2 motor = \$25,950
For No. 3 motor:
Total no-load loss capitalization = 43.1 × \$240 = \$10,350
Total load loss capitalization = 102.9 × \$25 = \$2,570
Total yearly loss, capitalized = \$12,920
Price of motor = \$12,500
True initial cost of No. 3 motor = \$25,420

In the above illustration No. 1 motor has the smallest total losses, the lowest price, and yet it is really the most expensive motor, costing \$1,580 more than the "highest price" motor No. 3. Another interesting point is that Nos. 2 and 3 motors have the same total losses and yet No. 3 motor is really cheaper than No. 2 motor despite a favorable price difference. From the illustration it is apparent that relatively high no-load losses may make a piece of apparatus more expensive to buy and use than others which carry a higher sales price and the same total losses. The curves also indicate that the lower the load factor the more the disparity in actual capital outlay for equipments which have the same price and same total losses but considerable difference in proportions of the losses. In general, it is found that large differences of "true initial costs" occur frequently in practice, particularly in cases of a large ratio of hours connected to hours loaded and where there is considerable varying differences in no-load losses and losses at rated load, although total losses may be the same for all.

A bit of the Colonial Exposition

Impressions of

By M. LUCKIESH

Director Lighting Research Laboratory, General Electric Company, Cleveland, Ohio

AN ANALYSIS of the present is chiefly of value in gaging the future and in setting the compasses accurately, or at least hopefully. An appraisal of European lighting, if confined to details, is not very helpful. With few exceptions, the technical details present little that is new to lighting practice in this country. Excepting the latest products of foreign ingenuity the tools of lighting are quite the same the world over. Therefore, one way to find more of interest and value is contemplating the woods instead of the trees.

Artificial lighting is always intricately entwined with habits, customs, traditions and economies. It rises with difficulty above the prevailing standards of comfort, convenience and productiveness. If one ignores these factors, his conclusion is easily arrived at. A statement to the effect that European lighting in general is far behind lighting in this country summarizes the situation. However, the value of such an appraisal is properly in proportion to the lack of penetration. Aside from a few new details which can be summarized in a brief space, this country can chiefly profit from European lighting by a deeper and broader understanding. Besides, if appraisals of lighting abroad are to possess depth—in fact, if they are to be fair and generous—they must be based upon historical, economical and sociological considerations.

As one surveys the lighting from country to country, he not only is confronted with an ever-changing complexity, but often finds himself at sea because of the absence of common ground. Europe is a world of contrasts. Extremes are very apparent and obtrusive. There are high standards of living, but low standards are widespread. There are many rich persons, but poor people are more prevalent than we are used to. Comfort and convenience are to be had, but from our viewpoint, discomfort and inconvenience are far too plentiful. There are modern things and ideas, but they are hemmed in by the old. Traditions and antiquities are interesting, even romantic, but they also apply brakes to progress.

There are many good lighting installations, but artificial lighting in general is at a far lower level than in this country. There is no lack of ingenuity and progressiveness on the part of the lighting interests of Europe. The general backwardness is due chiefly to the fact that the task is far more difficult in Europe than in this country. When one sees what has been accomplished in modern lighting developments abroad, notwithstanding the economic and the traditional difficulties, one is likely to acclaim less loudly the progress in this country.

During the first week in September London was treated to its first floodlighting of consequence. In this country we have long been thinking of ways and means to rescue floodlighting from the commonplace. Imagine the streets of one of our large cities hopelessly blocked for hours by entangled traffic brought out several nights to see buildings floodlighted! True, the buildings were Buckingham Palace, Houses of Parliament and many other historical buildings. Westminster Abbey, filled with dimming history, stood out against the night sky in the beams of many lamps. Big Ben's face glowed with amber light. Many monuments of light, prophetic beacons, rose from a dim city where gas lighting still predominates. Among the thrills of historical buildings made visible at night a practical American could not help wondering why the recipients of the dole had not cleaned the centuries of soot from these monuments.

European Lighting

Some excellent street lighting, both gas and electric, emphasized the dimness of miles of streets of poor gas lighting. Show windows also exhibit the extremes of contrast. But even the excellent installations sink to the level of the many poor ones at an early hour in the evening, for the lights are turned off! Window shopping in London after 7 or 8 o'clock is rarely possible. This is a common condition throughout Europe.

London is rising here and there out of the darkness of a score of years ago in this country. Other cities in England and Scotland—Glasgow, Edinburgh, Sheffield and Birmingham—are also awakening, but poor lighting is very prevalent. In these cities gas lighting still predominates, especially upon the streets. However, as was true in this country during the last stand of gas lighting, the gas-lighting interests are keeping up with their competitors in so far as their greater difficulties permit. St. James's Park in London was floodlighted by gas, involving difficulties that our electric-lighting specialists might well note by way of encouragement.

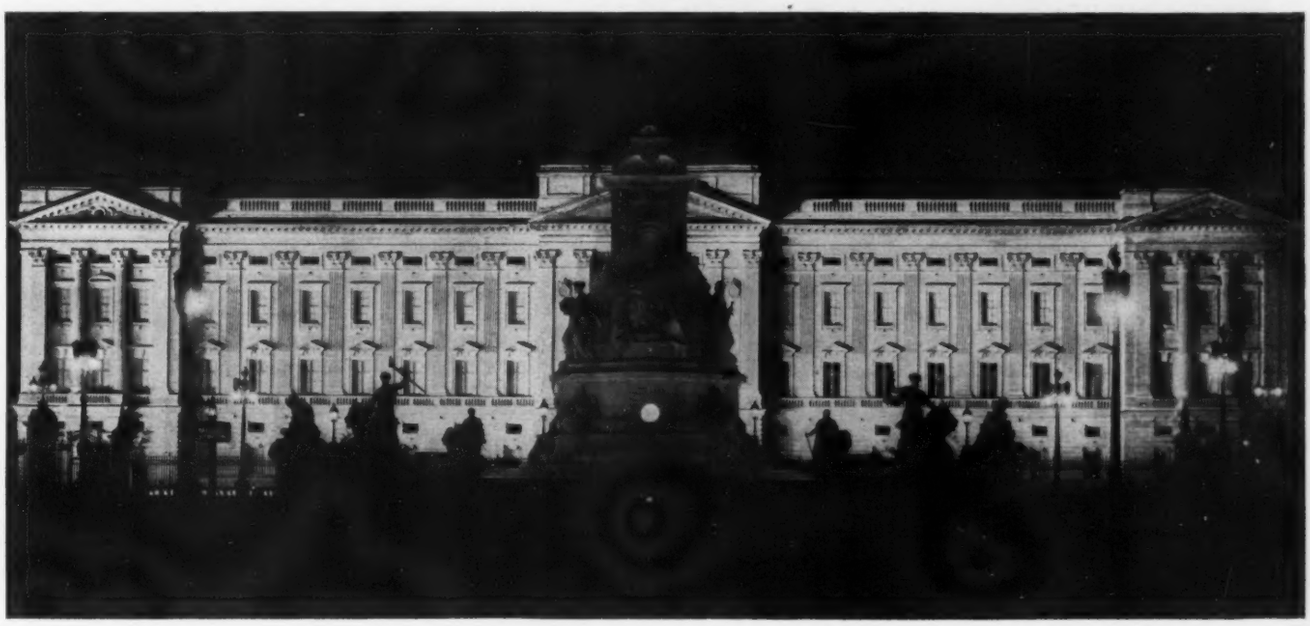
In Edinburgh one was treated to a very delightful floodlighting. Edinburgh Castle should meet the ideals of any one. It is high, isolated, large and old—everything a castle should be. The rambling walls, towers and battlements seemed to hang high in space as viewed through the night mist. It was like a dreamland castle or a fairyland doll house, a treat indeed. Still, one of the newspapers, entangled by tradition, more than hinted that the lighting interests were guilty of irreverence.

One does not escape the world of contrasts and extremes in the industrial cities. Occasionally, amidst lighting and environment reminiscent of a score of years ago in this country, an excellent industrial building, well lighted, clean and ventilated, stands as a symbol of hope.

Opal glass in a Berlin interior

Paris is not much different from New York from a lighting viewpoint, excepting that New York has much more good lighting. Furthermore, from the viewpoint of buildings and interiors treated in the modern manner, New York is well ahead in quantity, and to some degree in quality. Of course, Paris has its Champs Elysées, Arc de Triomphe and Place de la Concorde, providing an openness and an opportunity for lighting which have not been neglected. New York has the talent, the daring

Buckingham Palace and the Victoria Memorial use 100 kw. of floodlighting



and the purse, which have been so utilized in lighting that it must be ranked even ahead of Paris.

The temperament, esthetic sensibility and artistic ability of the French can always be depended upon to make an art of anything they combine to do. They were a long time grasping the idea that artificial light is a medium of expression, but when they awakened to this they went to work, unhampered by tradition, which in some European countries provides a serious, if not an unsurmountable, obstacle. France is blessed with craftsmen in glass who produce a variety of artistic products.

Berlin is outstanding in the use of opal glass

As a consequence, glass areas of all kinds have readily become a part of lighting installations for utility or decoration, or both. Perhaps the best wholesale example of the recent use of light as a decorative medium by the French lighting artists was the Colonial Exposition. Here light and brightness were used as they should be—to please, regardless of efficiency, provided the cost is within the proper budget. For example, streets were lighted by vertical strings of opaque cones. These were painted white and each concealed electric filament lamps. The efficiency for street lighting was very low, but it was gratifying that this was ignored for the sake of effect. Such installations should eventually convince engineers that they have emphasized efficiency too much.

At the Colonial Exposition the French lighting artists utilized hundreds of different kinds of lighting effects. They may be summarized under the principle of light for decoration regardless of efficiency, just as ornamentation, sculpture, frescoes and coffered ceilings have long been used without being hampered by considerations of efficiency. It can scarcely be said that Paris originated the idea of light as a medium of expression, but it has accomplished much in making the idea visible and practicable.

In countries which are just beginning to emerge from the age of mere light examples of good lighting are confined chiefly to large cities. France is no exception to this, for the outlying cities are still in artificial twilight.

Holland, the home of the Philips Company, manufacturer of electric light sources, shows the influence of this progressive company. Modern lighting at present seems to be confined chiefly to diffusing-glass pendent units of various shapes.

Gaseous tubes are somewhat in evidence, but notwithstanding the start which Europe had with these sources, they do not appear to be in use any more than in this country. Research laboratories are seriously experimenting in the development of such sources and some interesting sources are in the experimental stage. In several European laboratories researches on gaseous tubes and vapor lamps are being pushed seriously.

Berlin might be termed the city of opal glass—at least as viewed externally. The electric sign with visible filament lamps is rapidly giving way to translucent glass signs. The use of opal glass is extending to borders of store fronts, vertical strips on the faces of buildings, horizontal cornices and other elements. The over-all effect is excellent. The streets have a finished and refined appearance which a motley array of all kinds of signs destroys. Elaborate uses of gaseous tubes are also in evidence. Of course, Berlin is a modern city and the problem of lighting development is not as difficult as in the older cities.

One cannot escape a feeling of prosperity as one views Berlin externally and internally. Perhaps this is due to contrast with the older cities, but it is also due to the progressiveness of the Osram Company and other lighting interests in developing lighting. The offices and showrooms of the public service companies are well lighted and tastefully decorated. Each one radiates something of the wonders of artificial lighting. But beneath determined activity in Germany is an undercurrent of despair due to the hopelessness of paying out more money in reparations than the country creates. At least this is a universal complaint.

The older cities of Germany are by no means as backward in lighting as they are in some other countries. Cologne has some good street lighting and show windows blaze forth until late in the evening. So it is in Nuremberg, Munich and elsewhere.

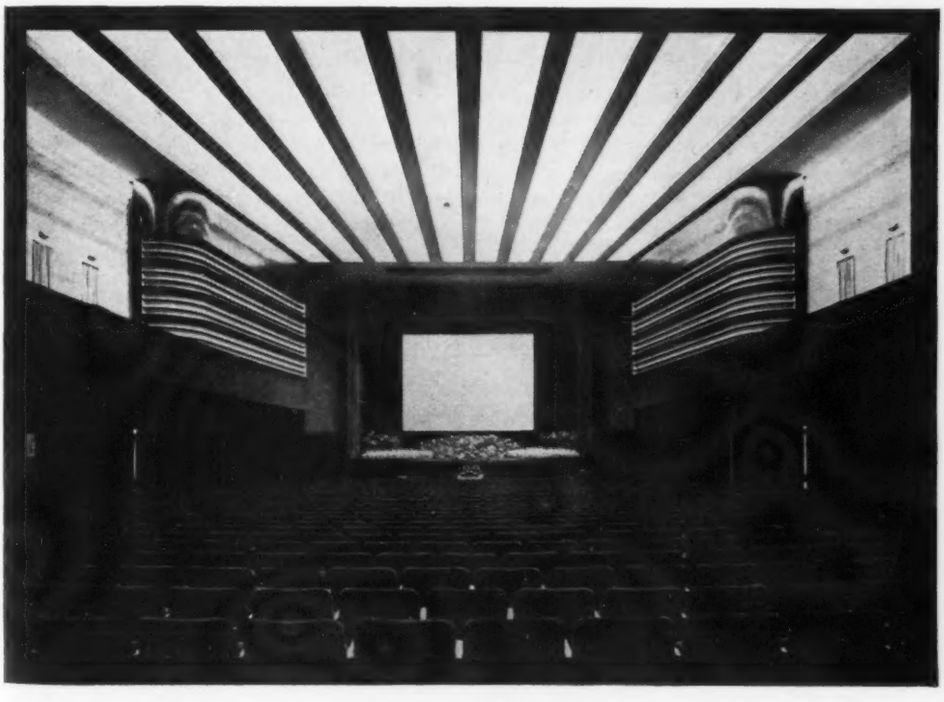
Switzerland, with its scarcely tapped resources of "white coal," is electrified thoroughly. Imagine the many Alpine peaks packed between Cleveland and Chicago or between Philadelphia and Pittsburgh! With their crests receiving snow all year and storing this frozen water to provide perpetual power. Switzerland need not be frugal in the use of electricity. Modern lighting in Switzerland is going forward confidently. As new uses for electricity are found, one sees in Switzerland a great future.

Entering Italy, one comes to Milan, the industrial metropolis, where artificial lighting is being developed

A Parisian theater in which light and architecture are blended intimately

by progressive interests. Italy presents emphatic contrasts of the very old with the new. It was one of the first countries to receive Edison and his new ideas of a half century ago. The contrast electrically between England and Italy is interesting. The former, with its coal and its early developments of gas lighting, is still a gas-lighted country. The latter without coal, but with the Alps in the north, is an electric-lighted country, at least in the cities. A transmission line of very high voltage is projected the entire length of Italy. But there are drawbacks. Uniformed soldiers are to be seen everywhere, courteous, quiet reminders that Mussolini will not brook disorder. Everywhere new work is to be seen and workmen are busy. If it must feed its unemployed, the government seems determined to have no unemployed. It may be obliged to provide a dole, but it provides work along with it. All this means taxes, but taxes are better than idleness, unrest and anarchy. Consequently, electric energy is taxed. A large portion of the consumers' light bill is paid to the government directly. Imagine the difficulty of lighting development where the use of electricity is directly penalized by high taxes! Lighting interests in this country are not confronted with this obstacle. In fact, it is seen that they are relatively unhampered compared with the European developers of lighting.

Throughout Italy are many examples of good lighting. One sees a modern Italy growing out of the dark ages of history and of metaphor. Italy and Germany impress one as being nearest together in a modern sense. Modern Germany sprang up recently, unhampered to a large extent by tradition and ancient buildings. Italy is rising from old cities and ruins. But Italy has its extremes too. Bicyclists pedaling homeward at dusk hold a lighted candle in a paper sack as a matter of law and common sense. They go home to simple meals and inexpensive wine. A dollar-a-day income the year around is probably a great deal of money, as it is to many millions in Europe. Compare the difficulties of developing the use of electricity in the homes and on the farms of most of Europe with those in this country. Think of developing commercial lighting where shopkeepers turn on the light when a prospective customer enters and bid him adieu with another snap of the switch.



A Berlin theater

As our lighting specialists read the European journals and look across the sea in their imagination, they are likely to be quite satisfied with their achievements. Even if they travel abroad making mental comparisons, they may criticise Europe as being backward. However, Europe has made many fundamental contributions which lighting in the entire world eventually profited by. Considering the matter with the breadth and depth which accuracy demands, the lighting interests of this country can scarcely credit themselves with doing more than a fair job where the task is relatively easy. What would be the result in this country if we worked as hard at the lighting job as we would have to in order to do a fair job under European conditions?

▼

Comparative Costs of Flat, Truss and Unit Substations

To compare quantities and costs of material for three main types of outdoor substations, namely, unit, truss and flat construction, the station design subcommittee of the N.E.L.A. electrical apparatus committee assumed a wiring diagram and applied each form of construction to it.

The substation used for this study consisted of two sections, a 44-kv. structure with five line connections and a transformer connection and a 140-kv. structure with five line connections and a transformer connection. The 44-kv. wiring diagram consisted of a single oil circuit breaker for each connection, by-passed with air-break switches, and a transfer oil circuit breaker between the main and transfer buses. The 140-kv. wiring diagram consisted of a single oil circuit breaker on each feeder which connected to two buses through motor-operated disconnecting switches. The 140-kv. buses were sectionalized with four motor-operated disconnecting switches with a bus-tie oil circuit breaker between the buses.

The results of this study showed that there was little difference in the cost of the 44-kv. substation for the three designs, although there was a small saving in favor of the flat type if the value of the real estate was low. When the labor was added the costs of the three schemes were practically the same.

For the 140-kv. substation it was found that the flat type was the most economical, if the real estate costs were low, and the truss type the most expensive. The total difference in cost of the material for the two schemes amounted to about $7,000. The greatest variable for the three structures was the amount of steel used. It should be noted that only about 33 per cent of the steel required for the truss type was needed for the flat type. However, the savings in steel were offset to some extent by the increase in concrete for footings and for bus material.

The wiring diagram used for the study of the 140-kv. substation was such that the flat type was at some disadvantage, since it was necessary to provide two strain towers for each connection instead of one, which would be ample if a double bus with two breakers or a straight single bus were used. The steel required for such a structure would be about 30 per cent less than that needed for the double-bus, single-breaker arrangement.

The accompanying tables itemize the costs of each construction, but do not include apparatus costs common to all three designs and hence cannot be assumed to give total costs.

*Comparison of Material Costs**

140-Kv. Typical Substation

Items	Flat (or Low) Type Quantity	Cost	Truss Type Quantity	Cost	Unit Type Quantity	Cost
Site						
Ground area (sq.ft.)	59,000	$5,900	34,000	$3,400	55,000	$5,500
Grading	.....	415	.....	320	.....	415
Cinder fill (cu.yd.)	900	620	640	440	900	620
Fencing (ft.)	565	790	450	630	565	790
Lighting units	8	360	22	880	8	360
Lighting conduit and cable (ft.)	1,000	500	1,100	550	1,000	500
Foundations						
Bus footings (cu.yd.)	12	120	.....	.....	8	80
A-frame footings (cu.yd.)	240	2,400	140	1,400	340	3,400
Structures						
Structural steel (tons)	46	5,658	168	21,500	72	8,900
4-in. pipe (ft.)	650	815	.....	.....	440	550
Controls						
Duct run (6 x 8) 2-in. fiber (ft.)	585	4,500	520	4,000	585	4,500
1¼-in. galv. conduit (ft.)	410	700	8,200	1,400	410	700
Hand holes	5	750	3	450	5	750
Control cable (5-cond.) (ft.)	29,000	7,500	22,000	5,700	29,000	7,500
D.C. power cable (1-cond.) (ft.)	1,900	1,330	1,450	1,000	1,900	1,330
Main Wiring						
4/0 cable (ft.)	2,000	290	3,800	550	5,500	800
3-in. copper tubing (ft.)	1,300	2,700	.....	.....	.....	.....
2-in. copper tubing (ft.)	950	1,050	.....	.....	750	825
1½-in. copper tubing (ft.)	.....	.....	.....	.....	.....	.....
1-in. copper tubing (ft.)	1,000	520	1,750	910	450	235
Conductor fittings	.....	1,200	.....	600	.....	300
Insulator strings	83	2,600	124	3,900	119	3,750
Insulator stacks	53	4,820	54	4,600	45	4,100
Total cost	.....	$45,538	.....	$52,230	.....	$45,905

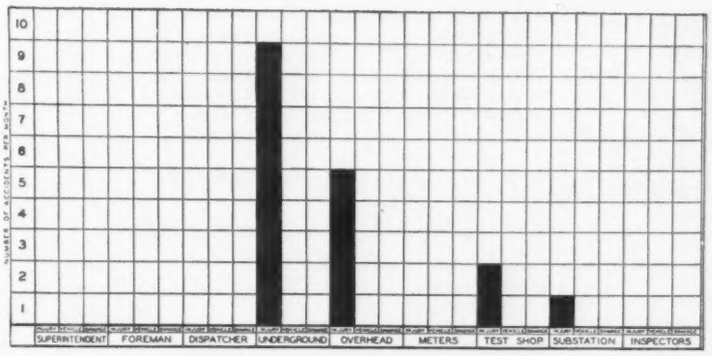
44-Kv. Typical Substation

Items	Flat (or Low) Type Quantity	Cost	Truss Type Quantity	Cost	Unit Type Quantity	Cost
Site						
Ground area (sq.ft.)	19,000	$1,900	$10,300	$1,030	20,000	$2,000
Grading	.....	140	.....	85	.....	150
Cinder fill (cu.yd.)	307	215	195	140	350	225
Fencing (ft.)	460	640	400	560	460	640
Lighting units	8	360	7	280	8	360
Lighting conduit and cable (ft.)	650	325	250	125	650	325
Foundations						
Bus footings (cu.yd.)	13	130	.....	.....	.....	.....
A-frame footings (cu.yd.)	135	1,350	32	320	180	1,800
Structures						
Structural steel (tons)	38	4,674	38	4,900	50	6,150
4-in. pipe (ft.)	650	815	.....	.....	.....	.....
Controls						
Duct run (6 x 8) 2-in. fiber (ft.)	190	1,500	180	1,400	215	1,660
1¼-in. galv. conduit (ft.)	240	400	410	700	300	510
Hand holes	2	300	2	300	2	300
Control cable (5-cond.) (ft.)	5,000	1,300	4,000	1,080	5,700	1,480
D.C. power cable (1-cond.) (ft.)	1,000	700	750	525	1,120	800
Main Wiring						
4/0 cable (ft.)	1,200	180	.....	.....	3,200	465
3-in. copper tubing (ft.)	.....	.....	.....	.....	.....	.....
2-in. copper tubing (ft.)	.....	.....	.....	.....	750	825
1½-in. copper tubing (ft.)	720	650	850	770	.....	.....
1-in. copper tubing (ft.)	1,025	540	2,950	1,550	450	235
Conductor fittings	.....	600	.....	400	.....	300
Insulator strings	47	940	31	620	62	1,240
Insulator stacks	39	1,130	162	4,700	6	174
Total cost	.....	$18,789	.....	$19,485	.....	$19,630

*Note: — Apparatus costs, common to all three designs, are omitted.

Hazard Index Method for Comparing Accident Risk

By LELAND W. MILLER
Electric Distribution Department
Los Angeles Gas & Electric Corporation,
Los Angeles, Calif.



ACCIDENT CHART

JULY 1931

KEY
PERSONAL INJURY
VEHICLE ACCIDENT
PROPERTY DAMAGE

DEPARTMENT	PERSONAL INJURIES			VEHICLE ACCIDENTS		DAMAGE			RATING		
	AVERAGE NO. MEN	DEGREE OF HAZARD	CLASSIFICATION			NO. OF CLAIMS OR UNITS	DEGREE OF HAZARD	CLASSIFICATION	PERSONAL INJURY	VEHICLE ACCIDENT	DAMAGE PERCENT
SUPERINTENDENT	23	0.1%	1-1000.	1.4					0.1%		
FOREMAN	30	2.08	1 - 49.	22.5					2.08		
DISPATCHER	32	3.77	1 - 26.	39.4					3.77		
UNDERGROUND	159	29.56	1 - 3.4	63.1					29.56		
OVERHEAD	182	31.78	1 - 3.2	57.2					31.78		
METERS	28	2.74	1 - 37.	34.3					2.74		
TEST SHOP	38	3.07	1 - 32.5	35.5					3.07		
SUBSTATION	155	24.83	1 - 4.1	54.5					24.83		
INSPECTORS	12	1.37	1-120.	23.					1.37		

A method that reduces hazards to a common denominator, making it possible to compare the exposure to accident in different kinds of work.

Forecasts the expectancy of accident in any given position and gives a complete analysis of each workman's duties, making it possible for the executive to select the operations needing the closest safety supervision.

Enables management to compare own accident record with that of other plants.

PECULIAR set-ups existing in the light and power industry make comparison of accident records almost impossible, or at least of very little value. With a view to developing some standard method of determining hazard so as to establish a base for comparison, the Los Angeles Gas & Electric Corporation evolved the "hazard index." In working up this method for charting the relative hazards in different types of work, the idea was held that it is possible to predict the type of injury to which an operative is exposed while performing a given operation. It is admitted that almost any type of injury can result from a given operation, but there is also a type of injury which it is logical to expect will result from misperformance of that particular work. It was thought then that if the maximum injury logical for the operation could be forecast a base or foundation on which to build would be laid.

A study of all reportable accidents covering a period of six years was then made and a typical injury was found for each and every operation involved, and while the severity of the injury varied from maximum to minimum, no consideration of this was necessary as exposure to hazard of maximum injury was the same in each case. After careful consideration of the data obtained from the above-mentioned study the hazard base was developed. This is a chart of the more common types of injury, with each type given a weight figure corresponding to the relative degree of disability experienced from that type as compared with other types. This chart embodies only the types of injury more common to our industry, but could be expanded to take in all types. Table I is the hazard base.

The next step was to list the men and their positions by departments and make an analysis of the duties of each man, listing their operations. In analyzing each operation it was a very simple matter to select the logical type of injury to which the operative was exposed. For example, since this study was made in the light and power industry, we will examine the operations of a lineman:

Operation No. 1—Works on lines up to and including 4,000 volts. An electric or flash burn is the logical type of injury for this operation and he was given twenty hazard points.

Operation No. 2—Climbs poles. Falls, even of short distance, usually cause fractures, so twenty hazard points were given for this operation.

Operation No. 3—Lifts heavy objects on pole. Awkward position in which to lift causes strains, of which herna is the worst type. Ten hazard points were given for this operation.

Operation No. 4—Wears climbing hooks. These are heavy iron leg braces having a long spur at the foot-plate for thrusting into the pole and they have caused many puncture wounds. He was given ten hazard points for this operation.

Operation No. 5—Solders joints. Hot solder is sent up pole on hand line and must be used before it cools. Given ten hazard points for metal burn.

Operation No. 6—Uses carpenter tools on pole. Use of these tools in an awkward position exposes him to two types of injury having the same weight, namely, strains and foreign bodies in eye. He was given five hazard points for this operation. If these two types of injury had been unequal in weight, the greater weight would have been awarded.

Summing up the lineman's hazard points, it is found

that they equal seventy-five, which figure is his hazard index.

Next the number of men in each position were counted and multiplied by the position's hazard index figure within each department to get the department's hazard index. For example, see Table II, giving underground department set-up. After determining the hazard index for each department in the same manner and adding these figures, a figure which is the total hazard index for the electric distribution department is obtained. This compilation is shown in Table III.

Each department's hazard index figure was then divided by the total hazard index figure to get the relative degree of hazard for each department. For example, the underground department has a hazard index of 10,067, which, when divided by the total hazard index of 34.049, gives 29.56, the department's degree of hazard figure. One hundred per cent was then divided by each of these percentage figures to get the hazard ratio, which is the expectancy of accident figure for the department. As an example, the overhead department with a degree of hazard figure of 31.78 when divided into 100 per cent gives 3.2, which means, by inference, that one in every three and two-tenths or five out of every sixteen accidents should be found in the overhead department. The unit of exposure per man in each department is then obtained by dividing the department's hazard index figure by the number of employees in the department. This is merely an average, but is of value in determining the location of the largest amount of hazard.

To use this method in contest work or for comparative purposes a graphic chart on which the figures can be shown and the accidents charted as they occur is necessary. Such a chart is here reproduced. It will be observed that this chart has provision for vehicle accidents and for property damage. Figures for these two types of accident are not included, as this is an explanation only of the method of charting physical hazards; enough to say, in passing, that the hazards in these types of accident are treated in much the same manner as those in personal injuries.

Operation of chart

The month is used as the time period for the comparison of departmental accident records. At the beginning of each month a new chart is made. When men have been added to or taken from a department the hazard index points of those men must be added to or subtracted from the department's total. This necessitates figuring a new degree of hazard for each department as the total hazard index will not be the same. The departments are then rated according to their degree of hazard and this percentage figure is shown at the right under "Rating." This means that each department is allotted that per cent of the accidents commensurate with its rating. As an injury occurs it is shown on the chart by blocking in a square in the division for the department in which the injured man was employed. This particular chart shows nine accidents occurring in the underground department, five in the overhead department, two in the test shop and one in the substation department. Thus, with only one accident during the month, the substation department has the best rating of the three major departments, as it was allotted 24.83 per cent and experienced only 5.9 per cent of the accidents. Additional weight is given severity of injury by subtracting 1 per cent of the department's degree of hazard for each day lost. When a fatality occurs 100 per cent is deducted.

Table I—Hazard Base

Lacerations	1	Hernia	10
Contusions	1	Poisons	15
Foreign body in eye	5	Asphyxiation	20
Sprains and strains	5	Flash burns	20
Puncture wounds	10	Electric burns	20
Metal burns	10	Fractures	20

Table II—Hazard Index for Underground Department

4 Foremen	at Hazard Index of 45	180
10 Assistant foremen	at Hazard Index of 45	450
47 Cable splicers	at Hazard Index of 75	3,525
27 Assistant cable splicers	at Hazard Index of 60	1,620
2 Carpenters	at Hazard Index of 60	120
6 Truckmen	at Hazard Index of 60	360
1 Compressor operator	at Hazard Index of 30	30
4 Field clerks	at Hazard Index of 35	140
2 Clerks	at Hazard Index of 1	2
56 Laborers	at Hazard Index of 65	3,640
	Department hazard index	10,067

Table III—Total Hazard Index

Superintendent's office		31
Foreman's office		706
Dispatcher's office		1,282
Underground department:		
Splicers and cable gangs	5,892	
Construction	4,175	
		10,067
Overhead department		10,822
Meter department		861
Meter test shop		1,352
Substation department:		
Operation	1,640	
Construction	6,810	
		8,450
Inspectors		476
Total		34,049

This method has been in operation in the electric distribution department for the past eighteen months and the results bear out the contention that it is the most equitable comparative method yet devised. Each type of position on the payroll was studied separately, its accident experience for the period found and compared with the figure given it by the hazard index method and the method was found to be 99.2 per cent correct with actual experience.

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Cleaning Transformer Cooling Coils

E. F. Houghton & Company report that they are now completely removing scale from the cooling coils of transformers by means of a semi-chemical method with no injury whatever to the copper tubing.

They first tried the mechanical method which consisted of wearing the scale loose by the abrasive action of a chain pulled back and forth through the tube. Slugging was impossible because of the coil construction of the tube. At best, the scale in a coil-shaped water cooler is removed only on the tension side of the chain. Several hours' labor by two men was required for the partial cleaning of one water cooling tube and the results were unsatisfactory.

Scale-removing chemicals were also used, but on account of attacking the copper they could safely remove only the outer layers of scale. This, of course, improved slightly a badly scaled condition, but it was not satisfactory because the chemicals not only attacked the scale but also attacked the copper tubing under the scale.

The present successful method involves the use of a cleaning solution of 70 lb. of 60 deg. sulphuric acid, 5 lb. of so-called "O" solution and 40 gal. of hot water. This solution is circulated for from one to two hours through the water-cooling tubes, returned to a tank and recirculated. The cleaning is done while the transformer is in operation. The solution is heated by the natural heat in the transformer without the aid of a steam-heating unit in the solution tank.

After cleaning, the water supply is connected to the cooling coil and water is circulated in the usual manner. The quantity of water which flows from the outlet of the water-cooling tube is significant of the results of scale removal. Thus a cooling tube of 1-in. diameter which before cleaning had an orifice of from $\frac{3}{8}$ of an inch to $\frac{9}{16}$ of an inch will after cleaning pass a full 1-in. flow of cooling water.

After one water-cooling tube is cleaned the equipment is then fitted to the next tube, the first one being put back into circulation, etc., until all tubes are clean.

It is declared that this same method of removing scale from water-cooling tubes is also suitable for cleaning superheaters, condensers, pipe lines, etc. The life of the tube with such cleaning is not reported.

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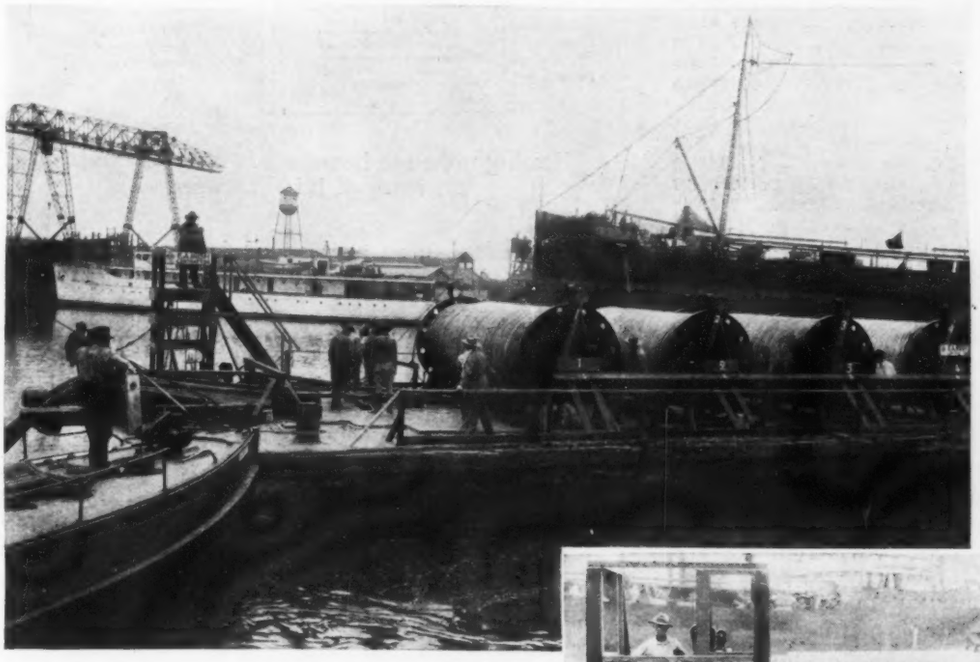
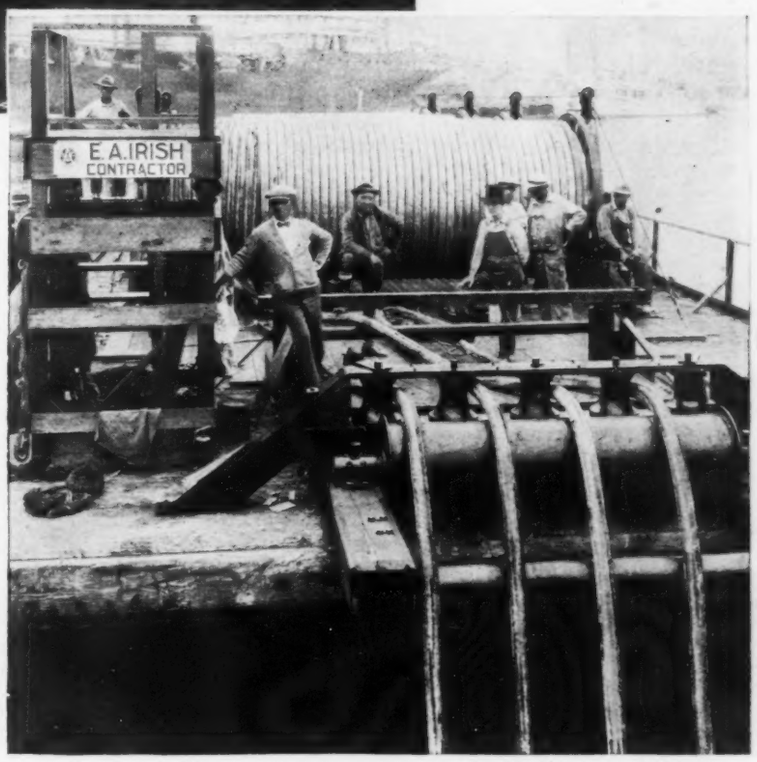
Four Cables Laid Simultaneously





Special cable reels and the barge equipments shown in the accompanying illustrations were used by the Southern California Edison Company, Ltd., in laying four cables simultaneously across channel No. 3 and the turning basin is Long Beach harbor. The cable was shipped by the manufacturer on four reels weighing 36 tons each.

The cables were laid in about 40 ft. of water in a 10-ft. trench, which was later partially backfilled to prevent entanglement with ship anchors. The guide rollers provided a separation of 3 ft., but as a precautionary measure a diver was sent down to make sure proper spacing was maintained. Four cables, each 2,750 ft. in length, were laid in one hour and forty minutes in this manner. The cable is of the rubber-insulated, non-leaded, armored type, three conductor, 350,000 circ. mil, rated at 13.5 kv. for 11-kv. operation.

Fat-Frying Kettle Pays Cost Quickly

A 4-kw., 220-volt deep fat-frying kettle at Putnam & Thurston's restaurant, Worcester, Mass., replacing two gas-fired kettles, paid for itself in less than four months, neglecting the scrap value of the discarded equipment. The electric kettle also produces better food at less cost. The cost of the new kettle completely installed was $260. Records of operating costs for over a year gave a net monthly saving of more than $77, as shown in the accompanying table.

Comparative Operating Costs of Gas-Fired and Electric Fry Kettles of Same Capacity

Gas-Fired Outfit

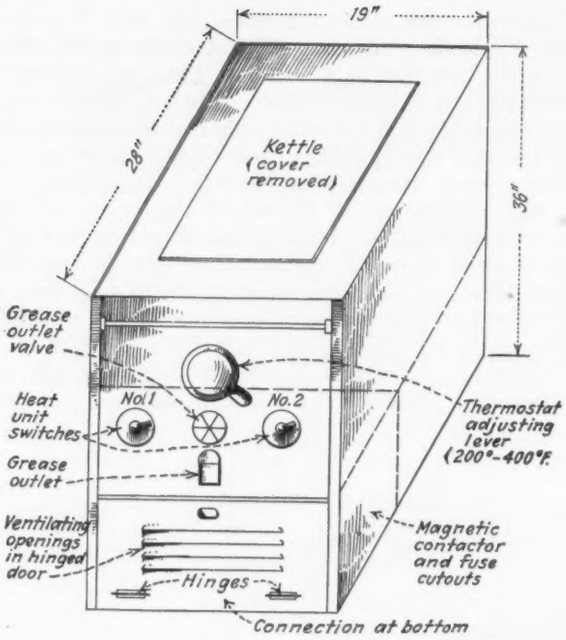
Fuel—$0.75 per day, per month for 30 days	$22.50
Make-up fats, 350 lb. $0.15	52.50
Loss of reclaimed grease 200 lb. $0.11	22.00
Total	$97.00

Electric Outfit

Average energy consumption, kw.-hr. per month	540
Cost of energy at 3 cents per kw.-hr., per month	$16.20
Interest on $260 investment at 6 per cent per month	1.30
Maintenance and depreciation, per month	2.20
Total, per month	$19.70
Net monthly saving,	$77.30

These economies are made possible mainly because of the accurate temperature control associated with the electric kettle and on account of the source of heat being immersed in the fat instead of being located under the kettle. These improvements prevent burning, save power, reduce fat consumption and keep the suspended food particles at the bottom of the container away from the surface, where the food is immersed for frying. With the electric method it was found that the expense of purchasing make-up fat is entirely eliminated and additional revenue is realized from the sale of extra grease. The improved separation of food particles from the top layers of heated fat permits putting more than one kind of food into the kettle without mixing flavors.

The electric kettle provides a desirable load on account of its operation on an average of fourteen to eighteen hours daily, including Sundays, and with unity power factor.



Heating units are immersed in fat to increase efficiency of B.t.u. transfer

The kettle has two heat-regulating switches, one for each heating element. By moving these switch levers to the low or high points it is possible to control the time of bringing the contents to the operating temperature, which is automatically kept constant by a Hart thermostat. The thermostat permits a range between 200 and 400 deg. F., the normal operating temperature being around 350 deg. Power is supplied through a contactor switch equipped with overload protection, each heating unit being provided with a separate set of fuses. Contactor and fuse cutouts are inclosed in an accessible lower front compartment.

The kettle was manufactured by the Edison General Electric Appliance Company, Inc.

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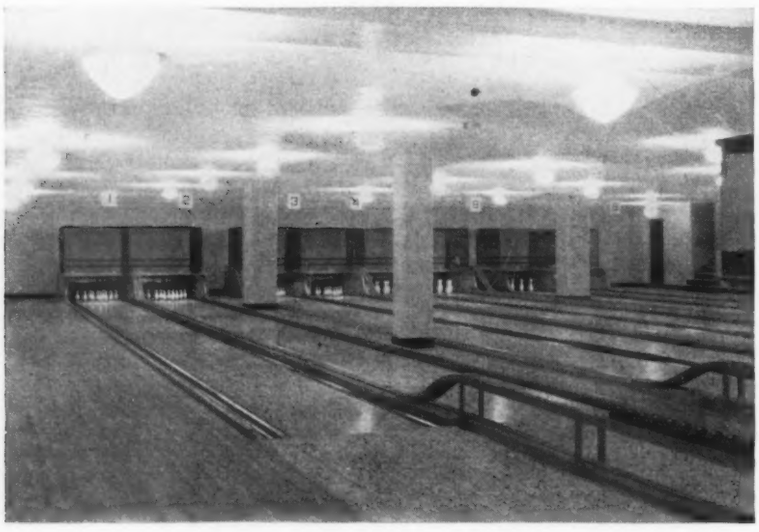

Spotting Pins with 25 Foot-Candles

Bowling alleys in the new building of the Aetna Life Insurance Company at Hartford, Conn., are illuminated by 150-watt lamps, while 200-watt lamps flood the pins with 25-foot-candle intensity. Holophane units were used and the installation exhibits unusually even distribution.

Men of the Industry

H. P. Charlesworth Nominated for A.I.E.E. Presidency

HARRY P. CHARLESWORTH, vice-president of the Bell Telephone Laboratories, Inc., has been nominated for the office of president of the American Institute of Electrical Engineers. Mr. Charlesworth is an outstanding figure in the telephone branch of the electrical industry, having spent his entire career in the development of telephonic operating methods and the general related engineering problems.

A native of Haverhill, Mass., and a graduate of the Massachusetts Institute

of Technology, Mr. Charlesworth entered the engineering department of the American Telephone & Telegraph Company, then located in Boston. His early assignments had to do with the development of telephone circuits and associated apparatus.

With the opening of the war he was specially assigned to handle problems wherein the Bell System could be of assistance to the government in the national emergency. In this capacity he was, throughout the war, active on communication facilities for army camps, naval bases, supply depots, and particularly for the government departments at Washington, where he also assisted the telephone company on general equipment and traffic engineering matters.

Shortly after the close of the war he became for a short time equipment and transmission engineer of the American Telephone & Telegraph Company, and in 1920 was appointed plant engineer of that company, in which position he was concerned with all phases of the engineering of the telephone plant and with relations with other wire-using companies. In December, 1928, he was elected vice-president of Bell Telephone Laboratories, where he now directs operations involving more than five thousand people engaged in development, research and related activities pertaining to the communication art.

Mr. Charlesworth became a member of the American Institute of Electrical Engineers in 1922 and a fellow in 1928. He was a manager 1924-1927, chairman of the meetings and papers committee 1927-1929, chairman of the New York Section in 1929 and became vice-president from the third district and member of the board of directors in 1930. He has served on many Institute committees, being at present a member of the executive, co-ordination, institute policies, finance, legislation affecting the engineering profession, technical program, Edison and Lamme medal committees. He is also a representative of the Institute on the board of United Engineering Trustees, Inc., a member of the National Research Council, Division of Engineering and Industrial Research, vice-chairman of the Electrical Standards Committee and a member of several other scientific organizations.

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SAMUEL INSULL, JR., resigned as president of the Midland United Company and was elected vice-chairman. ROBERT M. FEUSTEL, executive vice-president, was elected president and WILLIAM A. SAUER, vice-president and general manager, was elected executive vice-president.

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A. N. GEYER, who for several years has been associated with the Utah Power & Light Company in the capacity of maintenance engineer, recently resigned that position to join the organization of the Woodward Governor Company, with headquarters at Seattle, Wash.

•

S. J. NYSWONDER, merchandising manager for the northwestern Pennsylvania properties of the Associated Gas & Electric Company, has resigned to became affiliated with the Suburban Electric Development Company, distributor of Frigidaire electric refrigeration. His position will be that of original dealer contact man and his headquarters will be in Pittsburgh. Mr. Nyswonder has been with the Associated System four years.

Edison Medal Awarded to Edwin W. Rice, Jr.

THE EDISON MEDAL for 1931 has been awarded by the American Institute of Electrical Engineers to Dr. Edwin Wilbur Rice, Jr., "for his contributions to the development of electrical systems and apparatus and his encouragement of scientific research in industry." The Edison medal was founded by associates and friends of Thomas A. Edison and is awarded annually for "meritorious achievement in electrical science, electrical engineering or the

electrical arts" by a committee consisting of 24 members of the American Institute of Electrical Engineers. Edwin W. Rice, Jr., is one of the pioneers of electrical development in the United States and has played a conspicuous part, in association with the late Charles A. Coffin, in the building of General Electric.

As a schoolboy in Philadelphia he came in contact in 1876 with Prof. Elihu Thomson, then a young teacher in the Boys' Central High School. His natural fondness for mechanics and later for electricity was quickly developed by this association, and when in 1880 the professor gave up teaching to go into electrical manufacturing as scientist and inventor, young Rice gladly accepted an opportunity to become his assistant. He went with Prof. Thomson to New Britain, Conn., in the old American Electric Company, and later to Lynn, Mass., upon the organization of the Thomson-Houston Electric Company. At the age of 22 he was

made plant superintendent and had this full responsibility until the consolidation of the Thomson-Houston Electric Company and the Edison General Electric Company in 1892, under the name of General Electric Company.

In the new company Mr. Rice was first made technical director, then vice-president in charge of manufacturing and engineering. He eventually became senior vice-president, and in 1913 he succeeded Mr. Coffin as president of the company. In 1922, after nine years' service in that office, he was succeeded by Gerard Swope. Dr. Rice at that time was made honorary chairman of the board, which position he still holds. In the course of his career he has contributed much in the way of organization methods, improved factory routine, technical development and engineering and scientific inventions.

His degrees are: Honorary A.M., Harvard (1903); Sc.D., Union University (1906); doctor of engineering, Rensselaer Polytechnic (1917); Sc.D., University of Pennsylvania (1924). He is a past-president and a fellow of the American Institute of Electrical Engineers and a Chevalier de la Legion d'Honneur of France. In 1917 he was decorated by the Emperor of Japan with the Third Order of the Rising Sun with cordon.

He invented the present fundamental form of high-voltage oil switch and the cellular system of separating buses and circuits, as well as the application of synchronous converters to the building of unified alternating and direct-current distribution systems. He was responsible for the adoption by General Electric of the Curtis steam turbine and for the establishment of the General Electric research laboratory.

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ERVING G. BETTS has been appointed power sales engineer of the western district of the New England Power Engineering & Service Corporation with headquarters in Northampton, Mass. A native of Merrimac, Mass., Mr. Betts was educated at the Massachusetts Institute of Technology. His early business career included connections with the New England Telephone & Telegraph Company and the Fort Wayne Engineering Company. For the four years prior to the managerial acquisition of the Massachusetts Lighting Companies by the New England Power Association he was power sales engineer for the former organization.

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GALT F. PARSONS has been appointed power sales engineer of the southeastern district of the New England Power Engineering & Service Corporation, a subsidiary of the New England Power Association, with headquarters in Quincy, Mass. Mr. Parsons was born in Oswego, N. Y., and graduated from the Massachusetts Institute of Technology in 1906. After serving the Stone & Webster interests at Terre Haute, Ind., as assistant to the manager of the Terre Haute Traction & Light Company, he was transferred in 1908 to the same position in the Blackstone Valley Gas & Electric Company at Woonsocket, R. I. In 1911 he joined the Worcester Electric Light Company as power sales engineer and in 1912 was made manager of the power sales departments of the utilities under the management of C. D. Parker & Company, Boston. When these were transferred to New England Power Association management in 1930 he was established at the Boston headquarters.

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R. H. Morse Heads Fairbanks, Morse & Company

ROBERT H. MORSE, formerly vice-chairman of the board of directors of Fairbanks, Morse & Company, has been

elected to the positions of president and general manager to succeed W. S. Hovey, who resigned December 1. In 1895 Mr. Morse entered the employ of Fairbanks, Morse & Company, which was founded by his father, C. H. Morse. He began his career with the company as an apprentice at the Beloit factory (then known as Fairbanks-Morse Manufacturing Company) and, except during his military service, when he was lieutenant-colonel in the Signal Corps, has been with the company continuously since that time. In the 36 years he has been employed in various positions as salesman, department manager, branch house manager, sales manager, president of the manufacturing division, vice-president in charge of purchases, first vice-president and vice-chairman of the board.

Mr. Morse is also a director of E. & T. Fairbanks & Company, Canadian Fairbanks-Morse Company, Ltd., E. & T. Fairbanks Company, Ltd., and Central Republic Bank & Trust Company.

OBITUARY

Albert M. Patten

ALBERT M. PATTEN, president of the Kansas subsidiaries of the North American Light & Power Company and one of the best-known figures in electric utility operation in the state, died in a hospital in Topeka of meningitis, which developed from an ear infection. Mr. Patten headed the Kansas Power & Light Company, the Kansas Gas & Pipe Line Company and the United Power & Light Company of Kansas. He went to Topeka as a boy when his father removed from New England to take charge of the old street car line as the representative of the bondholders. He attended Washburn College and then entered the street car business, advancing to the superintendency of the street car line.

When the Studebaker-Insull interests obtained control of the power interests in northern Kansas Mr. Patten was made president and general manager of the operating organization. Recently he was relieved of the duties as general manager.

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Gardner S. Williams

GARDNER S. WILLIAMS, well-known engineer, died December 12 in Ann Arbor, Mich., after a long illness. For many years Mr. Williams had been recognized as one of the leading authorities in the field of hydraulics. He served at Cornell University as professor of experimental hydraulics from 1899 to 1904 and was head of the hydraulics department at the University of Michigan from 1904 to 1911. Since that time he had engaged in consulting engineering, specializing in hydraulics and water power.

Mr. Williams had been for some years a vice-president of the American Engineering Council and a year ago served as acting president during the absence of Carl E. Grunsky, who was making a trip around the world. He was a member of the American Society of Civil Engineers, American Society of Mechanical Engineers, Western Society of Engineers, Detroit Engineering Society, Grand Rapids Engineering Society and Michigan Engineering Society.

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W. H. PRESCOTT, a director of the Reliance Electric Company and prominent in industrial circles in Cleveland, died December 14 at his home in that city. Mr. Prescott was a partner in the Saginaw Bay Company, a lumber business, and in addition to being a director of the Reliance Electric Company he also served on the directorate of the Cleveland Trust Company, the Guardian Trust Company, and the Osborn Manufacturing Company.

Financial and Statistical News

WITH all sense of values utterly abandoned, utility common stocks took the sharpest drop of any week this year before the selling movement was temporarily arrested. The average of 37 of the leading stocks sagged to 36.9 from 42.3 last week. This week's average is exactly half of the high point for the year, but several individual issues, of course, are much smaller fractions of their high for the year.

——THOSE WHO HAVE BEEN WATCHING THE BOND MARKET for advance signs of a definite turn in stock prices, and later business, have little encouragement yet, as bond prices in general recede to new lows for the entire depression period. There are, however, fairly definite signs of gradually increasing steadiness in several groups. U. S. Government and highest grade utilities particularly are displaying such a tendency.

——THE UTILITY FIELD IS NOT WITHOUT ENCOURAGING SIGNS. Earnings are still well sustained. One group has actually increased its personnel by a substantial addition. Isolated companies are showing a gain in earnings this year over last.

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Electric Service Data, by Counties

STATISTICS ON THE NUMBER of homes having electric service have just been issued for 25 states by the Electric Equipment Division, Department of Commerce, as the result of a joint study in co-operation with the National Electric Light Association. It is expected that data for the remaining states will be available for distribution shortly.

For each county the number is given separately for urban and rural homes, as well as the total. In addition, the tables show the number of wired homes in each city having a population of 2,500 or over. State totals are given for urban, rural and aggregate population as well as the corresponding numbers of wired homes. The data are as of August 31, 1930.

The initial publication is in three sheets, the first for Indiana, Kentucky and Utah, the second for Wisconsin, Tennessee and Louisiana, the third for Michigan, Missouri and Arizona. Subsequently the fourth sheet was published, embracing the states of Idaho, Arkansas, Mississippi, Nevada and Delaware.

Later issues include, on sheet 5 Ohio, Alabama and the District of Columbia; on sheet 6 Virginia, Oklahoma and West Virginia; on sheet 7 Illinois and Montana; on sheet 8 Washington, Florida, Colorado, Wyoming and Maryland.

These are the first official statistics of the kind. They supersede the series compiled some years ago by the ELECTRICAL WORLD, the last of which gave the numbers of customers by counties as of January 1, 1926. The work was undertaken in response to requests from manufacturing concerns, advertising agencies, promotion departments of newspapers and periodicals and others interested in locating potential markets for electrical household equipment.

Small-Utility Stock Split to Preserve Local Control

AUTHORITY TO EXCHANGE 1,200 shares of its common capital stock, on the basis of $25 per share, for all of its outstanding common stock in the aggregate par amount of $30,000 was granted last week to the Sherrard Power System, Orion, Ill., by the Illinois Commerce Commission. The company also was granted authority to issue and sell $60,000 of its 7 per cent cumulative preferred capital stock for reimbursements and extensions.

In its application the company sought permission to exchange 3,000 shares, on a valuation of $10 per share, for all of its outstanding common capital stock. The company's aim in this step, the commission pointed out, apparently was to assure control of the company's management by the stockholders, "who have developed the properties from a small beginning to their present proportions." The proposed split-up of stock, the commission stated, is desirable, but not in the ratio of 10 to 1 as proposed by the company.

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Sustained Bond Prices an Essential to Recovery

RENEWED selling in the bond market has brought prices in certain groups to new low levels, disabusing some observers of their hope that the sustained level during October and November was an advance signal of the business turn. An upward turn in bond prices is still regarded as a necessary precedent to the stock market and business recovery.

After reaching a low point early in October, utility and other bond averages recovered several points. Early in December, however, renewed weakness brought prices down to and below the early October bottom. Government issues receded in the face of the heavy financing program that must be undertaken by the treasury. Foreign bonds in general weakened in sympathy with the generally unsatisfactory situation abroad. Then there has been some switching from high to lower grade issues in the hope of greater appreciation in values later. All these influences must be regarded as responsible for depressing utility bonds, since nothing in the industry itself would warrant present price weakness.

In the case of utility bonds the price movement, as reflected by the average yield of twenty representative issues, fluctuated widely in the last two years. The average yield of this group at the beginning of last year was 2.91 per cent. By the end of 1930 it had risen to 4.37 per cent. This declined to a low of 3.60 in March, 1931, and then started upward, reaching a high of 6.05 per cent for the first week of October. Since that time it has remained fairly stable.

Any sustained rise in bond prices must be attended by certain favorable consequences. It would improve the position of savings banks, insurance and trust companies and other large institutional investors. It would also provide a more receptive market for sound bonds which were not marketable at a favorable price during the last year or two. Business recovery obviously depends in no little degree on the ability of legitimate enterprise to secure ade-

CURRENT EARNINGS REPORTS OF ELECTRIC LIGHT AND POWER COMPANIES

Operating Companies

	1931	1930	Per Cent Increase	Operating Ratio 1931	Operating Ratio 1930
Alabama Power & subs. (Year ended October 31)					
Gross earnings	$17,852,963	$18,009,272	— 0.9	43	42
Net earnings	10,175,850	10,436,601	— 2.5	..	..
Consumers Power (Year ended October 31)					
Gross earnings	31,036,297	32,662,144	— 4.9	42	46
Net earnings	17,844,220	17,685,348	0.9	..	..
Georgia Power* (Year ended October 31)					
Gross earnings	25,299,444	26,399,344	— 4.2	49	49
Net earnings	12,966,255	13,292,108	— 2.5	..	..
Kansas City Power & Light (Year ended October 31)					
Gross earnings	14,812,008	14,814,756	— 0.0	45	49
Net earnings	8,172,949	7,527,811	8.5	..	..
Ohio Edison (Year ended October 31)					
Gross earnings	18,286,452	19,291,331	— 5.2	40	40
Net earnings	11,057,290	11,616,519	— 4.8	..	..
Southern California Edison (Year ended October 31)					
Gross earnings	40,954,283	41,168,772	— 1.0	33	32
Net earnings	27,415,119	27,773,471	— 1.0	..	..
Tennessee Electric Power (Year ended October 31)					
Gross earnings	13,830,884	15,163,511	— 8.8	49	52
Net earnings	6,988,265	7,280,071	— 4.0	..	..

* Columbus Electric & Power included.

† Net after expenses, taxes and retirement of fixed capital, etc.

Holding Companies

	1931	1930	Per Cent Increase	Operating Ratio 1931	Operating Ratio 1930
American Commonwealths Power & affil. cos. (Year ended September 30)					
Gross earnings	$23,484,777	$24,155,479	— 2.8	55	61
Net earnings	10,414,146	9,424,631	10.5	..	..
American Power & Light & subs. (Year ended September 30)					
Gross earnings	84,376,754	87,924,331	— 4.0	48	48
Net earnings	44,167,565	45,801,051	— 3.6	..	..
American Water Works & Elec. & subs. (Year ended October 31)					
Gross earnings	50,870,026	54,654,134	— 7.0	51	50
Net earnings	24,674,863	27,041,327	— 8.7	..	..
Associated Gas & Electric System† (Year ended October 31)					
Gross earnings	109,583,993	109,360,071	0.2	59	57
Net earnings	44,571,736	47,021,008	— 5.0	..	..
Commonwealth & Southern & subs. (Year ended October 31)					
Gross earnings	132,091,444	143,368,933	— 7.9	47	49
Net earnings	70,136,879	73,206,033	— 4.2	..	..
Eastern Utilities Associates and constituent cos. (Year ended October 31)					
Gross earnings	9,262,696	9,229,686	0.4	58	59
Net earnings	3,881,427	3,741,796	3.7	..	..
National Power & Light & subs. (Year ended September 30)					
Gross earnings	78,245,395	81,030,736	— 3.4	53	55
Net earnings	36,320,746	36,652,377	— 0.9	..	..
Nevada-California Electric & subs. (Year ended October 31)					
Gross earnings	5,756,647	5,626,109	2.5	48	48
Net earnings	3,001,566	2,904,322	3.3	..	..

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quate capital, and any sustained improvement in the bond market is regarded as of vital importance.

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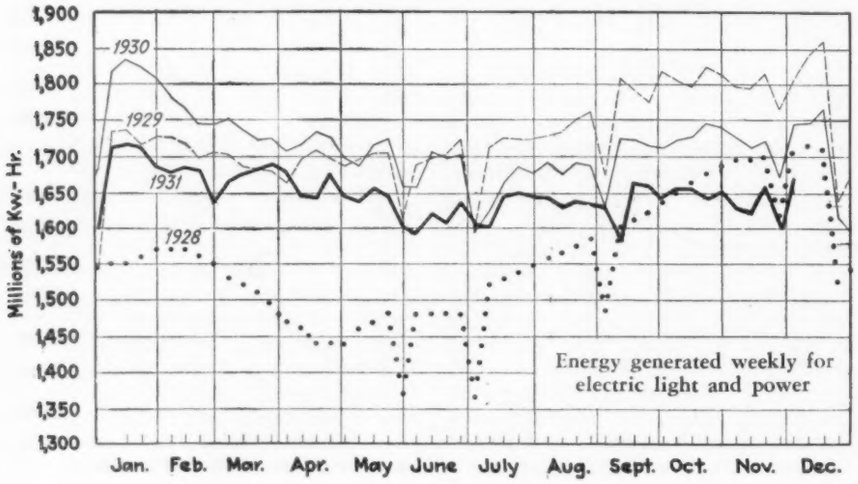
Weekly Energy Output

THE ACCOMPANYING TABLE gives the production of energy by the electric light and power industry in recent weeks and in corresponding periods of other years, as announced by the National Electric Light Association. Beginning with the week ended November 21, the output has been below that of 1930, successively, by 3.9, 4.3, 4.3 and 4.4 per cent.

	1931	1930	1929	1928
November 7...	1,628	1,728	1,798	1,697
November 14...	1,623	1,713	1,794	1,696
November 21...	1,655	1,722	1,818	1,701
November 28...	1,600	1,672	1,718	1,619
December 5...	1,671	1,747	1,806	1,706
December 12...	1,672	1,748	1,841	1,716



Ontario Hydro Reserves Show Steady Growth

AN INCREASE IN THE RESERVES of the Ontario Hydro-Electric Power Commission and the municipalities taking Hydro service is indicated in a special review prepared by J. R. Cooke, chairman of the commission. Although the fiscal year of the co-operating Hydro utilities does not close until December 31, when precise data will become available, Mr. Cooke states that the total accumulated reserves of the commission and the municipalities now exceed $116,000,000. These reserves, he states, have been increasing by some $13,000,000 to $14,000,000 annually.

The statement points out that more than $264,000,000 is invested co-operatively in generating and transforming stations, transmission lines, general equipment and office and service buildings, using capital advanced or guaranteed by the province, which is being steadily repaid by the contracting municipalities out of their revenues from consumers. In addition about $105,000,000 of investment in local distribution utilities and other assets has been financed by the municipalities individually, through their own bonds and surplus earnings, and this investment also is rapidly being placed on a debt-free basis. The total investment in the undertaking, including rural service, exceeds $369,000,000.

The figures given by Mr Cooke indicate an increase of approximately $12,000,000 in the reserves since the last annual report of the Hydro Commission. Increases of $4,000,000 and $6,000,000 in the capital investment of the Hydro systems and municipal undertakings are shown, the 23d annual report, for the year ended October 31, 1930, showing $260,593,779 invested in the systems, generating stations, hydro-electric railways, office and service buildings etc., and $99,054,262 in the municipalities' distribution systems, etc., a total of $359,684,041 a year ago compared with the $369,000,000 investment at present.

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NEW ENGLAND POWER ENGINEERING & SERVICE COMPANY, subsidiary of the New England Power Association, Boston, Mass., has voted to increase the authorized common stock by 400,000 no-par shares, making a total of 600,000 no-par shares of stock.

Automobile, Food and Rubber Industries Rise

INDUSTRIAL activity in November moved upward nearly 2 per cent compared with October if allowance is made for the smaller number of working days. The increase was slightly greater than in 1930, when the index rose from 103.2 to 104.3. The present level is about 5 per cent below last year's. These conclusions are based on monthly returns received by the ELECTRICAL WORLD giving the electrical energy consumption in individual manufacturing plants throughout the United States and analyzed by industry groups.

The upward turn that will probably be noted with the greatest interest is in the automobile and accessories industry; it amounts to 14 per cent and brings the index for that industry to the highest point since last June. The change is in harmony with the increase in employment recently reported.

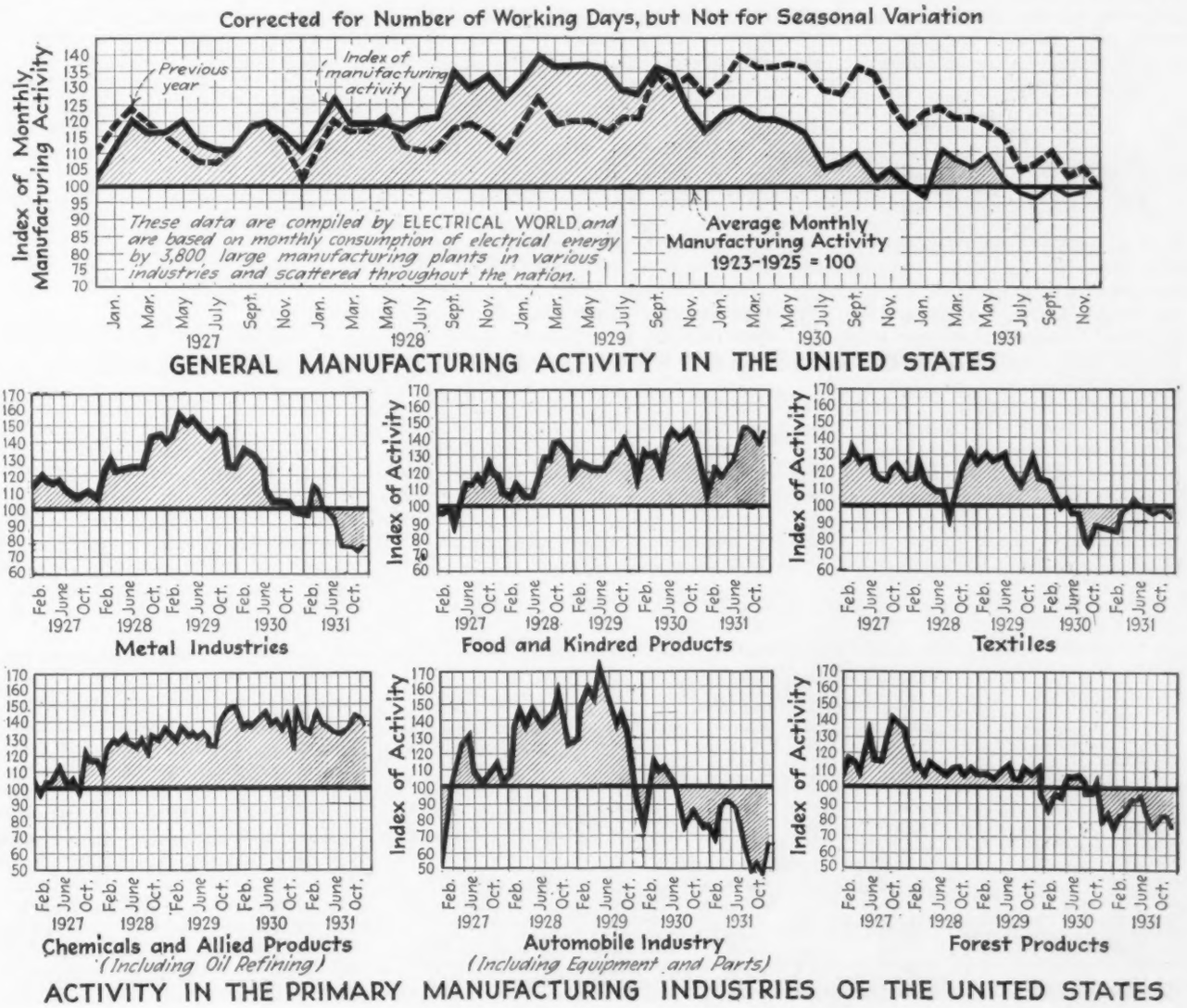
Food products also turned upward, contrary to the usual trend at this season of the year, to the highest value reported for November in any year. A third unusual gain is that in rubber products, which not only exceeded the activity of October but overshot the corresponding figure of 1930 by 2 per cent. In the metals group, while operations in the iron and steel industry continue to show no noteworthy change from the past three months and remain 28 per cent lower than in 1930, there has been a rise of 7 per cent compared with October in the metal-working plants.

The decline of 5 per cent in textiles and 8 per cent in leather leaves the former in a slightly better position than it had a year ago and puts the latter well above November, 1930.

Index of Manufacturing Activity

Base Average Month, 1923-25

Industrial Groups	November, 1931	October, 1931	Sept., 1931	August, 1931	July, 1931	November, 1930	October 1930
All Industry	**98.8**	**97.1**	**100.4**	**97.3**	**97.8**	**104.3**	**103.2**
Automobiles (including parts and accessories)	65.5	57.4	53.7	43.6	55.9	74.9	80.9
Chemical products (including oil refining)	138.0	142.0	144.6	137.6	137.7	145.0	122.4
Food products	144.0	136.5	142.0	146.4	147.0	124.4	137.2
Iron and steel	77.0	76.3	78.3	78.0	83.1	106.5	126.0
Metal working	76.0	71.0	75.0	73.3	69.3	99.0	87.0
Leather products	75.2	81.8	81.9	77.1	83.8	67.0	84.9
Forest products	76.4	81.2	82.2	79.4	76.9	91.9	77.1
Paper and pulp	126.1	113.0	138.3	121.7	104.0	119.2	120.0
Rubber products	93.5	82.8	88.0	98.5	97.4	91.5	99.0
Shipbuilding	95.0	84.5	88.9	85.6	82.0	111.1	121.5
Stone, clay and glass	113.8	113.4	113.9	105.9	104.8	112.6	106.3
Textiles	93.4	98.2	98.7	95.0	98.2	92.4	85.4


Corrected for Number of Working Days, but Not for Seasonal Variation
Index of Monthly Manufacturing Activity
Previous year
Index of manufacturing activity
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the nation.
Average Monthly Manufacturing Activity 1923-1925 = 100
Jan. Mar. May July Sept. Nov.
1927 1928 1929 1930 1931
GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES
Index of Activity
Feb. June Oct.
1927 1928 1929 1930 1931
Metal Industries
Food and Kindred Products
Textiles
Chemicals and Allied Products
(Including Oil Refining)
Automobile Industry
(Including Equipment and Parts)
Forest Products
ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Markets

Westinghouse Makes Italian Connection

AN AGREEMENT FOR AN EXCHANGE of patents and experience has been concluded by the Westinghouse Electric & Manufacturing Company and the Westinghouse Electric International Company with the leading Italian electric manufacturing concern, Ercole Marelli & Company of Milan. Westinghouse companies do not participate in the management of the Italian company.

The relationship will be similar to that between the Westinghouse companies and the Siemens-Schuckertwerke of Germany, whose manufacturing line parallels that of the Westinghouse company in the United States. Although Siemen & Halske control the majority of the Schuckert company's stock, the parent company is more closely related to General Electric than to Westinghouse.

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Australian Electrical Manufacturers Merge

THE MERGER OF SEVEN electrical companies formerly operating independently in Australia is announced. They include Australian General Electric Company, British Thomson-Houston Company, Edison Swan Electric Company, Ferguson Pailin, Metropolitan-Vickers (Australia) Pty., Metropolitan-Vickers Electrical Company and Australian Electrical Manufacturing Company.

This announcement follows initial steps taken late in 1930 when the Australian General Electric Company, Metropolitan-Vickers Electrical Company and Ferguson Pailin organized the Australian Electrical Manufacturing Company, to co-ordinate their activities. Later this new company acquired Weymouth, Ltd., of Melbourne and thereby added transformers to its list of products.

Following the launching of Associated Electrical Industries, Ltd., of Great Britain it is understood that the British group, in co-operation with the International General Electric Company, initiated the further merger of the Australian interests, forming for the purpose a holding company called Associated General Electric Industries, Ltd. The new concern covers the entire field of electrical products.

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Trade Practice Rules for Contracting Industry

THE Federal Trade Commission has approved and accepted a number of trade practice conference rules adopted by the electrical contracting industry at its trade practice conference held in Kansas City, March 18, 1931. These rules have also been approved and accepted for the industry by a committee appointed at the conference to act for the industry.

The conference adopted 23 rules dealing with various trade practices. The commission, after consideration, has reworded several and has divided them into group I, which rules the commission has approved, and into group II, which the commission has accepted as expressions of the trade. The commission declined to accept or approve one resolution adopted by the industry.

The group I rules pertain to the following subjects: Inducing breach of contract; enticing competitors' employees; defamation of competitors; selling goods below cost; shipping products which do not conform to samples submitted; using materials or methods of installation not in accordance with the applicable governmental laws; secret rebates; knowingly aiding or abetting another in the use of unfair trade practices.

The group II rules cover such matters as regulations for territories where no governmental laws or regulations prevail; irregular bidding on contracts, and general policy regarding bidding; circulation of price lists; making terms of sale a part of published price schedules; definition of a qualified wholesale distributor; accurate methods of cost finding; arbitration; and a committee on trade practices.

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Appliance Accounting System Suggested

A SEPARATE ACCOUNTING SYSTEM covering sales of appliances by utilities seems suggested by the recent hearing in Albany on merchandising activities of the utility companies. The hearing resulted from complaints made with regard to certain sales practices. The purpose of such separate accounting would be to guard against the absorption in electric rates of losses resulting from merchandising sales.

Opposition to merchandising activities of utilities on the part of independent dealers has not developed in New York State as in some sections of the country. A definite disposition on the part of the former to co-operate is said to be the reason. But utilities are faced with the problem of how the accounting systems of the companies should handle cost of conducting appliance sales and also the legality of this type of business. The opinion of the utilities may probably be summed up in a statement made by E. J. Machold of Niagara Hudson Power Corporation at the hearing. Mr. Machold said in part: "The utilities be-

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DELINQUENT ELECTRICAL ACCOUNTS

(National Electrical Credit Association)

Number of Accounts Reported

Division	November 1930	November 1931	Per Cent Inc. or Dec.	Eleven Months 1930	Eleven Months 1931	Per Cent Inc. or Dec.
New York	197	202	+2.5	3,074	2,611	—15
Middle and Southern Atlantic	126	99	—21.4	1,699	1,265	—25.5
New England	97	102	+5.1	1,268	1,022	—19.4
Central	448	474	+5.8	7,648	6,077	—20.5
Total	868	877	+1.	13,689	10,975	—19.8

Total Amounts Reported

	November 1930	November 1931	Per Cent Inc. or Dec.	Eleven Months 1930	Eleven Months 1931	Per Cent Inc. or Dec.
New York	$25,762	$16,453	—36.1	$474,391	$328,282	—30.8
Middle and Southern Atlantic	15,587	9,713	—37.7	259,522	156,346	—39.8
New England	8,724	7,324	—16.0	162,070	86,949	—46.3
Central	46,389	39,675	—14.5	966,150	543,630	—43.7
Total	$96,462	$73,165	—24.2	$1,862,133	$1,115,207	—40.1

lieve that marketing appliances is part of the service of calling attention of customers to the latest and best methods of using gas and electricity. The business is such an intimate part of the whole service that we have a real basis for carrying it on as we do."

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TRADE BRIEFS

A. B. Spaulding, formerly assistant manager of Keasbey & Mattison Company's Philadelphia branch, has been transferred to the Ambler headquarters office as manager of the public utilities department of that company.

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Beginning January 1, 1932, refrigerator cabinets will be manufactured in the Mansfield Works of the Westinghouse Electric & Manufacturing Company.

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A series of bulletins describing its various classes of distribution, small power and large power transformers, designated bulletins 314 to 319 inclusive, has just been issued by the Moloney Electric Company. These bulletins are liberally illustrated and detailed descriptions are included.

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A new belt treatise compiled by E. F. Houghton & Company, Philadelphia, known as "Vim" short-center drives, has been announced. It is a new treatment of efficient short-center drives. The book contains charts, tables and engineering data on 5,000 standard "Vim" efficiency drives, ranging from 5 to 100 hp., and is built entirely around "Vim" special mineral tanned leather belting.

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James R. Kearney Corporation and the Chance Company have merged recently.

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Signal Electric Manufacturing Company, Menominee, Mich., announces the appointment of four new direct factory representatives: Handel-Davies Company, Cleveland; P. M. Day & Company, Detroit; Scott-Jacqua, Inc., Indianapolis, and W. C. Laing Cincinnati.

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J. G. Kilkenny Company, Cleveland, has been appointed representative in Ohio for W. N. Matthews Corporation, St. Louis, Mo., manufacturer of electrical specialties.

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R. B. Engineering Corporation announces a change in address from 11 West 42d Street, to the Evening Post Building, 75 West Street and 110 Washington Street, New York, N. Y.

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Metal Prices Remain Unchanged

	Dec. 9, 1931 Cents Per Pound	Dec. 16, 1931 Cents Per Pound
Copper, electrolytic	6.50	6.50
Lead, Am. S. & R. price	3.85	3.75
Antimony	6.25	6.25
Nickel, ingot	35	35
Zinc, spots	3.50	3.50
Tin, Straits	20.60	21.60
Aluminum, 99 per cent.	23.30	23.30

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EXPORTS OF ELECTRICAL EQUIPMENT (PRELIMINARY)

Article	October 1930	October 1931
Generators:		
Direct current—		
Under 500 kw.	$39,084	$30,930
500 kw. and over	.....	5,050
Alternating current—		
Under 2,000 kva.	10,277	16,724
2,000 kva. and over	14,796	325,000
Steam turbine generator sets	53,370	4,907
Accessories and parts for generators	38,008	26,107
Arc welding sets	55,591	34,720
Self-contained lighting outfits	57,358	43,524
Batteries:		
6-volt storage batteries	180,878	111,831
Other storage batteries	104,786	55,792
No. 6 dry cell batteries	34,862	26,486
Flashlight batteries	402,895	326,852
Radio B and C batteries (dry)	33,354	19,372
Other dry and wet cell primary batteries	12,732	7,128
Transforming or converting apparatus:		
Power transformers, 500 kva. and over	18,117	473,862
Distribution transformers, less than 500 kva.	62,054	30,704
Instrument transformers	24,311	11,492
Other transformers	58,021	34,582
Complete battery chargers under 15 amp.	12,597	2,026
Double-current and motor generators, dynamotors, synchronous and other converters	85,353	91,284
Transmission and distribution apparatus:		
Switchboard panels, except telephone	135,368	155,095
Power switches and circuit breakers over 10 amp	146,453	44,400
Fuses	27,232	10,887
Watt-hour and other measuring meters	49,858	32,050
Electrical indicating instruments	64,433	43,250
Electrical recording instruments	32,961	7,292
Other electrical testing apparatus	112,805	53,637
Lightning arresters, choke coils, reactors and parts	48,323	42,255
Motors, starters, and controllers:		
Motors, ¼ hp. and under	182,457	121,741
Motors, over ¼ and under 1 hp.	59,588	18,668
Stationary motors—		
1 to 200 hp.	233,419	89,242
Over 200 hp.	58,669	85,406
Railway motors	36,389	13,842
Electric locomotives—		
Railway	48,049	10,059
Mining and industrial	40,356	1,755
Station and warehouse electric motor trucks	.....	7,611
Starting and controlling equipment—		
For industrial motors	126,137	143,831
For electric railway and vehicle motors	10,751	134,153
Portable electric tools	82,055	58,041
Accessories and parts for motors	156,466	184,030
Electric refrigerators and parts:		
Household	396,139	313,069
Commercial up to 1 ton	118,666	74,663
Parts for electric refrigerators	.....	144,088
Electric appliances:		
Electric fans	37,495	22,104
Electromechanical health exercisers	9,268	1,300
Electric incandescent light bulbs—		
For automobiles, flashlights and Christmas trees	21,361	24,720
Other metal filament bulbs	72,477	71,280
Other electric lamp bulbs	10,427	7,278
Flashlight cases	100,981	33,535
Searchlights and floodlights	60,747	10,266
Electric household washing machines	109,886	120,461
Electric domestic vacuum cleaners	179,149	93,995
Other domestic motor-driven devices, except tools	62,472	30,358
Electric flatirons	15,870	18,449
Electric cooking ranges	67,888	18,740
Other domestic heating and cooking devices	109,006	53,356
Industrial electric furnaces, ovens, and other heating devices	127,846	21,874
Therapeutic and X-ray apparatus	156,768	50,724
Signal and communication devices:		
Radio apparatus—		
Transmitting sets, tubes, and parts	71,807	67,985
Receiving sets	1,357,424	1,757,183
Radio receiving tubes	175,128	224,264
Signal and communication devices (continued)		
Receiving-set components	601,862	596,327
Loudspeakers	139,958	80,797
Other receiving-set accessories	371,251	67,567
Telegraph apparatus	36,384	16,128
Telephone apparatus—		
Telephone instruments	54,222	15,952
Telephone switchboards	10,162	12,306
Other telephone equipment	269,777	67,446
Bells, buzzers, annunciators, and alarms	41,307	42,972
Other electric apparatus:		
Spark plugs	69,790	97,026
Other starting, lighting, and ignition equipment	100,794	34,478
Insulating material	59,978	42,490
Metal conduit, outlet, and switch boxes	102,764	43,249
Sockets, outlets, fuse blocks, and lighting switches	160,229	94,979
Electric interior lighting fixtures	207,391	95,175
Electric street lighting fixtures	40,017	13,780
Other wiring supplies and line material	147,186	61,558
Other electrical apparatus, n.e.s.	708,380	382,834
Rubber and friction tape	27,881	24,875
Globes and shades for lighting fixtures	48,020	31,602
Glass electric insulators	22,941	2,804
Electrical porcelain:		
For less than 6,600 volts	27,950	14,802
For 6,600 volts and over	48,281	28,951
Carbons and electrodes:		
Electrodes for electric furnaces	152,927	91,795
Other carbon products	43,657	47,443
Insulated iron or steel wire and cable	13,226	9,009
Copper, bare wire	70,068	22,134
Insulated copper wire and cable:		
Rubber-covered wire	41,424	25,866
Weatherproof wire	26,918	45,497
Telephone cable	21,464	2,439
Other insulated copper wire	238,930	93,582
Nickel-chrome electric resistance wire	.....	22,198
Totals	$10,116,157	$8,323,371
10 months ended Oct. 31	$110,475,903	$80,394,809

Market Conditions

ELECTRICAL equipment business in the Eastern district is still more or less marking time, but increased buying is indicated after the turn of the year. Heavy apparatus sales throughout New England have been dull, although merchandise sales have speeded up materially as a result of seasonal activities. Business in the Southeast continues quiet.

——THE PACIFIC COAST REPORTS BUYING OF HEAVY EQUIPMENT very dull, although power companies are buying line material and supplies in fair quantities.

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PACIFIC COAST

—WHOLESALERS AND THOSE *who handle varied lines consider that conditions are mending, whereas agents for specialties take a more pessimistic view and predict poor January and February trade.*

—PRICES ARE STEADY *and collections are better because of better payments by actual consumers. Building permits for eleven months show 43 per cent decrease in value for Los Angeles as compared with last year, 11 per cent decrease for Oakland and 1 per cent increase for San Francisco.*

Industrial prospects include a $1,000 sale of General Electric motors for pumps for a chemical company and a $1,500,000 biscuit plant projected for Los Angeles. Mining sales have been disappointing. The expected reopening of gold and silver mines produced some trading of parts but little buying of new electrical apparatus. Power company buying is again fairly brisk, with per haps ten carloads of line material bought this month. Machinery sales include $35,000 worth of General Electric regulators and switchgear equipment for the Vallejo district, $8,000 worth of General Electric motor-generator sets for the San Francisco civic group and two 600-amp., 110,000-volt oil circuit breakers of an approximate value of $25,000 for Los Angeles. Construction of a new $3,500,000 turbo unit for the Los Angeles territory will begin in April. Miscellaneous buying includes a carload of fiber conduit for Anaheim and a projected 80-light duplex street system for South San Francisco. Hospitals have succeeded post offices as the chief item of public construction, $2,000,000 being equally divided between two state jobs in Los Angeles and Yountville and two San Francisco institutions. Catholic building program will approximate $5,000,000 through a projected $500,000 Dominican institution. Other buying reflects seasonal conditions in better heater sales than for the past two years, though actual holiday purchasing of electrical material is not keeping pace with expectations.

Residence building in Seattle during November maintained a fair volume, the number of permits and amount spent exceeding that of October. Industrial and other construction, however, was negligible, with no indications of improvement, mainly because of inability to finance. The outstanding apparatus sale of the week was made by the General Electric Company to the Puget Sound Navigation Company, the order involving equipment for the Seattle-Bremerton ferryboat *Chippewa,* including a compressor set and a Diesel-driven generator, the total involving an outlay of somewhere between $7,500 and $10,000. Awards for motors for this installation are expected to be made shortly. Other sales reported include eighteen distribution transformers from 3 to 50 kva. to central stations, 35 fractional motors from ½ hp. down to miscellaneous sources, eight machines from 25 hp. down to a lumber mill, generating equipment for the fireboat *Alki,* costing about $5,000, secured by the Westinghouse company, and 30 motors from 50 hp. down to pulp and paper, lumber mills and dealers, ten machines from 25 hp. down to dealers and fifteen machines 15 hp. and under to small industrials.

CONSTRUCTION PROJECTS

Pacific Gas & Electric Company, San Francisco, Calif., plans equipment storage and distributing plants, with repair facilities, at Oakdale, Concord, Colusa and Hayward, Calif., to cost over $100,000. State Board of Education, Sacramento, Calif., plans science building at San Jose, Calif., to cost $200,000. Modesto, Calif., authorized installation of an ornamental lighting system. Commissioner of Indian Affairs, Tucson, Ariz., approved plans for a sanitarium near Sells, Ariz., to cost $125,000. Tillamook County Commissioners, Tillamook, Ore., authorized plans for a county court house to cost $160,000. Big Horn Dam Association, Hardin, Mont., R. B. Saunders, president, recently organized, contemplates hydro-electric power project on Big Horn River to cost over $500,000.

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SOUTHEAST

—THE VERY QUIET TONE *of business continues in the Southeast. The demand for large equipment seems to have dried up and even holiday lines are very slow in getting started; however, the weather has been very warm and it is hoped that the recent cold weather will serve to stimulate activities in seasonal lines.*

A few interesting orders were reported last week. A power company in the Carolinas ordered oil circuit breakers amounting to $30,000 and a barge company at New Orleans placed an order for sixteen radio transmitters which ran in excess of $25,000. A Georgia power company ordered regulators costing $10,000, while its creosoted pine pole and pole line material orders in the past ten days aggregated $4,500. A Tennessee company ordered $2,500 worth of street-lighting materials and a Louisiana company ordered $1,500 worth of metering equipment.

CONSTRUCTION PROJECTS

Louisville, Ky., plans manual training department in proposed junior-senior high school to cost about $900,000. Bureau of Yards and Docks, Navy Department, Washington, D. C., has an appropriation of $350,000 for buildings and other work at navy yard, Hampton Roads, Va., and asking bids until January 6 for administration building there to cost about $200,000. Treasury Department, Washington, D. C., is receiving bids until December 28 for post office at Atlanta, Ga., to cost $1,500,000.

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NEW ENGLAND

—ELECTRICAL EQUIPMENT SALES *remained steady during the past week, with heavier apparatus dull. Arc-welding apparatus, however, according to one leading manufacturer, has been decidedly active. Several long-pending sales have been closed and others will be put through before the month ends.*

Holiday sales of electrical merchandise are picking up rapidly and distributors are busy filling gaps in retail stocks which dealers failed to foresee, especially in hollow-ware and radios. Indus-

trial business is very quiet, barring scattered plant betterment work. A prominent engineering house is doing more industrial appraisal work which is likely to lead to betterment construction activities next year. Electric sign installations are increasing apart from seasonal applications and improved highway lighting is being sold for urban parkway use. New industrial power business shows some improvement in this territory.

CONSTRUCTION PROJECTS

Green Mountain Marble Company, Rutland, Vt., contemplates construction of a power plant. Department of Public Works, Boston, Mass., approved plans for office and operating building to cost about $1,200,000. Treasury Department, Washington, D. C., is having plans drawn for post office at Salem, Mass., to cost $360,000. Greenwich, Conn., plans manual training department in new high school to cost $325,000, and soon takes bids on general contract.

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MIDDLE WEST

—VERY LITTLE, IF ANY, *change in general business was observed this week in this section. General overall dullness and inactivity continues, although the situation seems improved a little. Major industries are maintaining their previous rate of activity, not without difficulty, however.*

Some improvement in the automotive field is observed, with Auburn placing contracts totaling $11,000,000, but as yet the principal producer of low-priced automobiles is still to be heard from. Industrial activity is considerably spotty and with the approach of inventory periods commitments have declined to a low level. Here and there increased activity in other than seasonal manufacturing is observed, which may mean that replacement levels have been reached or will be shortly. Carloadings continue to hold up fairly well, one carrier experiencing an increase, but the railroad situation is anything but encouraging. Retail merchants appear to be having a fairly good holiday season, but sales so far do not look to be unusually promising.

CONSTRUCTION PROJECTS

Plymouth, Wis., plans manual training department in proposed junior-senior high school to cost $200,000. South Haven, Mich., plans installation of electric-operated pumping machinery in connection with sewage disposal project to cost $150,000. Midland Steel Products Company, Cleveland, Ohio, will carry out expansion program to cost $100,000, including machinery. Galion, Ohio, authorized extensions and improvements in electric power plant to cost $150,000. Interstate Power Company, Dubuque, Iowa, secured franchise for transmission line to Magnolia, Minn., and plans early installation. Milford, Iowa, soon takes bids for equipment for electric light and power plant, for which bond issue of $80,000 has been voted.

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EASTERN

—WITH THE CLOSE APPROACH *of the year end manufacturers of electrical equipment in the Eastern district are looking forward to forthcoming 1932 central-station budgets. While these generally are expected to show lesser gross amounts than in recent annual periods, the announcements of many millions of dollars to be diverted to construction and improvement programs are sure to bring new life and interest into the situation. Immediate buying for this account has sagged to a low level, despite the most attractive prices for equipment and materials for many years.*

—GOVERNMENT PURCHASES *are another phase of early development and prospects are good for some sizable business from that quarter. Holiday trade for appliances and other electrical specialties continues light.*

On bids recently closing for a quantity of galvanized steel skeleton towers for the Department of Commerce, Washington, D. C., the Missouri Rolling Mill Company has tendered a low figure of $155 per unit. With an allowance for salvaged equipment, the Winton Engine Corporation has submitted a low quotation at $54,140 for a generating set for the United States Engineer Office at Buffalo, N. Y., and is expected to secure the order.

Railway account holds on an encouraging basis. The Pennsylvania Railroad Company is scheduling the completion of its electrification program between Manhattan Transfer, near Newark, N. J., and Philadelphia, Pa., within the next six to seven months. Westinghouse Air Company is advancing operations at its plant, following the recent order secured for equipment for 500 new cars for the Eighth Avenue subway, New York, totaling $1,750,000, said to be one of the largest single orders ever placed for air brakes and coupling apparatus. Baldwin Locomotive Works and Westinghouse Electric & Manufacturing Company are pushing construction of electric locomotives for the Pennsylvania Railroad.

Automotive business makes an encouraging prospect for electrical equipment for plant service after the turn of the year. Several of the larger companies at Detroit, Mich., are advancing production schedules and placing commitments for materials and accessories. Auburn Automobile Company, Auburn, Ind., has given orders totaling $11,000,000 for requirements for the first quarter of 1932 and will place additional contracts in the near future.

CONSTRUCTION PROJECTS

Bureau of Supplies and Accounts, Navy Department, Washington, D. C., is asking bids until January 5 for one motor-driven coil-winding machine for Brooklyn, N. Y., navy yard (Schedule 7063); until December 22 for motor-generator sets for New York, San Francisco, Hawthorne, Hingham navy yards (Schedule 7110). Buffalo General Electric Company, Buffalo, N. Y., has plans for two power substations, reported to cost close to $100,000. Lodi, N. J., plans manual training department in new junior and senior high school to cost $350,000. Bureau of Yards and Docks, Navy Department, Washington, D. C., is asking bids until January 6 for battery overhaul building, substation and acid-mixing plant at Mare Island, Calif., yard (Specification 6431). General Purchasing Officer, Panama Canal, Washington, D. C., is asking bids until December 28 for electric motors, watt-hour meters, wire and cable, and other electrical equipment and supplies (Schedule 2708).

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SOUTHWEST

—THE TURN OF THE NEW YEAR *is expected to bring better conditions to the Southwestern trade territory, but in the meatime the market is far from satisfactory.*

Christmas buying has helped somewhat in retailing domestic items, but the holiday sales of refrigerators, washing machines, ironers, radios and ranges is below expectations, with due allowance for general conditions. The next week, however, may bring a decided improvement in that direction. Orders of moment have gone through recently. Railroads and industrial concerns are holding back, while the utilities apparently are buying only for immediate needs.

CONSTRUCTION PROJECTS

Texas Agricultural and Mechanical College, College Station, Tex., will have plans drawn for three multi-story engineering buildings, to cost about $750,000. Octane Oil Refining Company, Baird, Tex., contemplates oil refining plant to cost $200,000. Southern States Refining Company, Shreveport, La., plans oil refining plant to cost close to $250,000.

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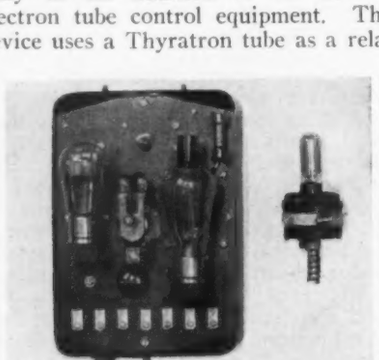
A SUBSTANTIAL GROWTH in business and encouraging prospects are reported by Electric Auto-Lite Company. Releases for December are far ahead of those for November and October, according to C. O. Miniger, president.

New Equipment Available

Photoelectric Relay for High-Speed Operation

A HIGH-SPEED PHOTOELECTRIC RELAY, designated CR-7505-G-5, has been introduced by the General Electric Company as an addition to its line of electron tube control equipment. This device uses a Thyratron tube as a relay



and finds its application in those operations where speed would be a limiting factor were a mechanical type relay used instead of the Thyratron.

The device is expected to be of greatest value in two general types of service, where the operation proceeds at unusually high speed and a relatively small amount of current is controlled by the relay and where the speed is less, although possibly still too great for a mechanical type relay, and it is required that a relatively large amount of current be interrupted. In the first class of service the Thyratron tube would serve as a relay, while in the second the tube would actuate a contactor. Among the suggested uses are the rapid sorting, selecting or registration of objects, high-speed counting and other applications where the time for response is too short for a mechanical type relay operating on a small amount of current rating.

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Ten-Hour Reserve Power Electrically Wound Switch

AN ELECTRICALLY WOUND TIME-SWITCH, kept wound by a constant speed a.c. motor, having ten-hour reserve power to carry through any ordinary current interruption, has been announced by the Sangamo Electric Company, Springfield, Ill. A jeweled balance with a non-magnetic, non-rusting, temperature-compensating, special-alloy hairspring guarantees dependable timing.

One of the features of this switch is a new contact which has a slow opening and a small gap. It is revolutionary, but has been thoroughly tested and is guaranteed by the makers. The standard switch has levers for three complete daily operations, allowing for either one, two or three, on-and-off periods each day. Manual operation does not affect the sequence of subsequent operations. A Sunday and holiday cutout is also supplied.

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AN EXPLOSION-PROOF CONTROL STATION, type BR-11, class 9001, of three-wire, momentary contact type, provided with one normally open and one normally closed contact inclosed in a cast-iron housing, has been announced by the Industrial Controller Division of the Square D Company, Milwaukee, Wis. It is so constructed that it will withstand an internal explosion without injury to the inclosure and without transmitting flames to the surrounding gases. It has been approved by the Underwriters' Laboratory for class 1, group d, for hazardous locations. The approximate dimensions are 6½ in. high over the mounting lugs, 3½ in. wide and 3¼ in. deep.

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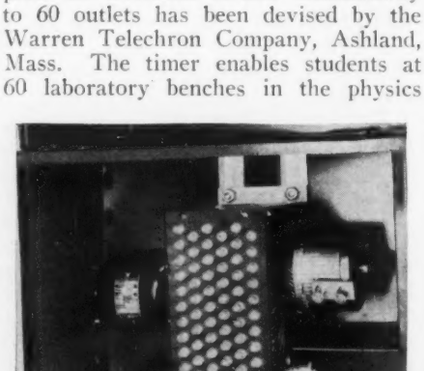
Impulse Timer Has 60 Outlets

A SPECIAL IMPULSE TIMER that will complete an electrical circuit momentarily to 60 outlets has been devised by the Warren Telechron Company, Ashland, Mass. The timer enables students at 60 laboratory benches in the physics



department of the University of Illinois to perform experiments at the same time, it is claimed.

The contact maker is driven by a 1/100th-hp. synchronous motor through a gear shift so that the impulses can be timed to occur either one, two, five or ten seconds apart.

Totally Inclosed Slow-Speed Motor

IN THE STERLING slow-speed motor just announced the speed is reduced to a suitable low value by means of totally inclosed, single, double and triple helical and herringbone gears built into the motor frame, making a rugged, compact, efficient, integral unit. Gear wheels and pinions are of the stub-

tooth type, accurately generated in precision gear-cutting machines. This type of gear insures smooth running, freedom from vibration, unnecessary noise, tooth shock, etc. No internal, multiple or planetary gears are used. Gears are run in an oil bath, insuring effective and ample lubrication of the teeth at their contact faces.

Thrust loads of gears are arranged to equalize each other where more than one reduction is used and 98 to 99 per cent gear efficiency per reduction is made possible owing to the new features employed. This efficiency is contrasted with the commonly accepted much lower efficiencies of worm gears. Sterling slow-speed and speed increaser units can be built on three-phase, squirrel-cage, slip-ring, high-torque, two-, three,- or four-speed motors, special or single-phase motors, etc.

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TO INCREASE THE EFFICIENCY OF LIGHT PROJECTION and furnish a lamp of better intrinsic quality, the 3,000-watt, 32-volt General Electric "Mazda" airport floodlight lamp is available in the G-56 bulb, globular in shape and 7 in. in diameter. The round bulb with the filament at the center eliminates the formation of a line of light due to internal reflections. The elimination of this feature makes for more precise control of the emitted light, a reduction in the amount of stray light, better field floodlighting and reduced glare. With the new round bulb it is permissible and practical to replace light-absorbing louvers in many equipments with light-reflecting mirrors, thus increasing the over-all efficiency of the lighting unit some 30 to 50 per cent.